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SOUTH AFRICAN TRADE.

A REPORT on the trade of South Africa in 1912, prepared by Sir R. Sothern Holland, H.M. Trade Commissioner at Cape Town, has just been published by the Board of Trade. This report, which contains an exhaustive survey of present conditions and immediate prospects of trade in the Union and Rhodesia, should have the careful attention of all firms interested in the market. On another page we publish some extracts from the report itself, but, obviously, it would be impossible to reprint the whole of even the more important sections of a report which covers some 50 or 60 pages of foolscap print. We hope, however, that the extracts we publish will serve to induce our readers to obtain copies of the report for themselves, so that they may study the remarks and suggestions therein contained.

In an interesting table of trade and population of the countries which are the largest buyers of British goods, Sir R. Sothern Holland shows that with a population no larger than 6,603,000, of which only 1,280,000 are Europeans, South Africa is sixth in value as a market for British goods, the total exports to the Union in 1911 from this country being over £20,000,000. The larger markets are India, Germany, Australia, United States and France, all of which, with the exception of Australia, have populations many times larger than that of South Africa. Moreover, of the total imports into South Africa, British goods account for 58 per cent., the imports from this country having increased from £14,000,000 in 1907 to £21,000,000 in 1912. When it is remembered that our share of the trade consists almost entirely of manufactured goods, and that some at least of our competitors largely owe what position they have to the supply of goods such as oils, timber, rice, grain, &c., which the United Kingdom, for natural reasons, cannot supply, it will be seen that this percentage of 58 per cent. represents much more than the actual figure indicates. Sir Sothern adds: "So long as a country's trade provides such healthy signs of stability as is reflected in the figures I have submitted, there is every reason for satisfaction, though I have no desire to make little of the danger which threatens us from foreign countries in many directions. It is impossible in a single report to draw attention to all the weak places in our armour, and, moreover, in my opinion, an annual review of trade is not the place to afford much information. It unnecessarily advertises our rivals and fails very often to reach the ears of those for whom it is intended." For ourselves, we should be inclined to strengthen the first part of this statement, and to contend that holding 58 per cent. of the total trade which, as we have shown, includes a large volume of commodities which we do not produce, foreign competition at present, at any rate, in its total (*i.e.*, rather than in a very few particular classes of goods) is of little importance. Later in his report the Trade Commissioner himself points out that the total shares of Germany and the United States are only 9 per cent. each. The thing to guard against is that in new trade which arises these countries should get a greater share than ourselves. As regards the latter part of the Commissioner's statement, we may point out that the activities of the Trade Commissioners are very often first

brought to the notice of firms here through these annual reports, and that if they are made colourless (by this we mean if they do not contain special information about special trades rather than general statements) firms who do not know the Trade Commissioners' work, as we know it, are apt to consider that their assistance would be theoretical rather than practical. We are inclined to think that the Commissioner under-estimates the number of firms who read his reports, or, at any rate, extracts from them in the trade and general Press.

From the particular point of view of the electrical trade the report contains much information which will be of interest to our readers. Sir Sothern Holland refers at some length to the importance to the electrical trade of the installation of electric power on the Rand, and gives figures which show that whereas the imports of electrical goods in 1907 were only £308,513, they increased to £1,428,888 in 1910; as installations were completed imports subsequently showed a falling-off, but in 1911 and 1912 respectively they amounted to as much as £1,030,627 and £917,186. The Commissioner points out that, unfortunately, the great bulk of these enormous supplies has been, and continues to be, drawn from foreign firms. From time to time he has discussed with the representatives of the companies concerned the loss of this important trade to British firms. The following interesting statement summarising the reasons for placing these orders abroad has been supplied to the Commissioner, and is submitted by him for the information of British firms. We give this statement in its original form, but would add our own opinion that the financial arrangements therein referred to have had the greater influence in deciding the country of origin of the majority of the supplies :—

"The business of generation and supply of electric power in the United Kingdom has developed on the lines of a series of small supply undertakings, as an instance of which might be cited the supply of power to London, where there are 14 different companies, 13 municipal supplies, and at least six stations for supplying the railway companies.

"Similarly, throughout the country small power stations are to be found situated within a few miles of each other, each serving their immediate district. As a consequence, the demands on the manufacturing industry in England have led to factories and designs suitable for supplying the requirements of such a market.

"On the other hand, both in America and on the Continent, the economy and advantage of large bulk supply power undertakings has been fully realised many years ago, and the electrical engineering business has been developed on the basis of having huge power stations, which sell in bulk to the different districts and towns.

"The Victoria Falls Co. is similar to the bulk-suppliers in America and on the Continent, as, in spite of the fact that the district served is relatively small, the amount of power to be supplied is probably greater per mile than in any other district in the world. This fact has led to the factories abroad obtaining experience and laying down machinery for producing mammoth plant and for supplying apparatus to deal with extremely high voltages necessary for handling these large amounts of power. On the other hand, the demand for large steam plant and the experience in Great Britain with boiler plant (both ashore and at sea) has placed the British boiler maker in a favourable position and, indeed, in advance of other nations; this has enabled the Victoria Falls Power Co. to place their business in boilers in the United Kingdom.

"When the company was first started it was desired to negotiate the securities in Great Britain, but this was not found to be possible. In the first instance, the bonds were taken in Germany, leading to the earlier industrial orders for the electric portion of the plant being placed in that country. The later issue of bonds has been taken in Great Britain, and for some time all orders have been placed in competition, and the best offers have been selected. In the case of machinery and apparatus for voltages which are not employed in England, the tenders received from abroad, as might be expected in view of the above particulars, are more favourable, but at the same time many orders are being placed in Great Britain, for all such work as the manufacturers are able from experience to produce."

As a result of the completion of these power works, Germany's total trade with South Africa, which amounted to £3,512,909 in 1910, has decreased to £3,230,021 in 1912; the imports from Germany in 1907 amounted to only £1,923,085. In 1912, however, the imports of electrical machinery from Germany were nearly double those from the United Kingdom. We have often pointed out in our columns that, particularly in new countries, investment of capital and trade go hand in hand, and the position in South Africa, as above outlined, again emphasises this fact.

That the statement quoted above underestimates the capacity of British firms to supply the needs of the new Rand works is not a point that we need discuss now. It is obvious from the fact that the Trade Commissioner quotes it in full that it is the accepted opinion in South Africa, and that, if they are to introduce their goods on the market, firms should have expert representatives who can talk them up and meet adverse criticisms. It is only in this way that our firms can hope to reap the full advantages which the South African market offers for trade expansion. As Sir Sothern Holland points out, it would be idle to suppose that sentiment does not play an important part in influencing the course of trade in favour of the Mother Country, but this sentiment is not always strong enough to secure that the business offering will come to us unless our firms make strenuous endeavours to obtain it. The report with which we now deal brings before us once again the fact that firms here have the advantage of a Government organisation in South Africa which is ready to give them practical assistance in advancing British trade interests, and we can only trust that they will use this organisation to the full.

Copper.

The strong upward course of copper prices can hardly have taken by surprise any who have studied the market in the light of the information which has appeared in these columns from time to time recently. If on occasion the upward movement has been too swift, it must be remarked that it followed as a rather natural reaction from an undue depression, arising out of the disturbed political situation in Europe resulting from the Balkan war and from the friction between the United States and Mexico.

The copper market owes its present strength mainly to continually recurring labour troubles in the United States and to the revolution in Mexico, the tendency of all of which has been to bring about a reduction in output, which is now making itself very apparent. Following upon the strike at the huge Nichols refinery a few months ago, which left its mark very plainly upon United States production for the month of June, when a reduction was shown of 8,600 tons, the whole of the workers in the Lake Superior district have since been "out," and this entailed a loss of output of refined copper of something like 8,000 tons a month.

It is possible that production will not suffer to the full extent indicated by this figure, because the smelters treating the Lake ore naturally had certain ore reserves in their bins upon which they could run for a time, but even so, it was not long after the men had thrown down their tools before the smelters had to close. True, the men have been filtering back to work for some little time now, but full resumption of operations is delayed, and the complete restoration of activity in the area affected can hardly take place for some weeks at the earliest. Considerable damage has been done to the mines by the suspension of pumping operations, and a good deal of new timbering and clearing up will have to be done ere they present the pre-strike appearance.

Meantime the statistical position of copper grows from strength to strength. Already at the end of July the world's visible supply was down to a record low figure at 60,700 tons against 98,000 tons at the end of January, and the European figures just issued show a further improvement, while all the trade anticipations are that the next United States returns due in a few days will reveal a further strengthening process. This must bring the world's visible supply of unsold copper to about the minimum below

which it cannot fall, and from then onwards, unless there should be some additional, and at present unforeseen, restraining influence upon production, a gradual increase in the stocks, and a slow return to more comfortable conditions should be seen. Last year low-water mark in this matter of visible supplies was reached at the end of August, and history has a knack of repeating itself.

The conditions which have recently beset the copper market must sooner or later give place to the normal, when, with a growing supply on hand, lower prices will prevail. It is fortunate indeed that with the statistical position indicating opportunities for prices being rushed up by speculators, there has been so little buying of the mere manipulative description. There is yet time for this to develop, but, in the best interests of the market, it is to be hoped that the gambling elements will remain in the background, for the consumer's position is sufficiently difficult and complex without the prices of his essential commodities being manipulated at the whims of the Stock Exchanges of London, New York and Paris.

Train Lighting.

FROM the reports published in the daily Press, it seems certain that the fire which added so greatly to the horrors of the railway disaster at Aisgill Moor, was caused through the fracture of the gas tanks or connections beneath the rear coaches of the train. The cases are far too numerous during recent years in which the use of gas as an illuminant has contributed to the loss of life and property, and has added nameless horrors to the sufferings inevitably accompanying a railway collision. It is less than three years ago since a train met with a similar accident within a mile or so of the scene of the present collision, and fire, originating from the system of gas lighting used, caused the death-roll to be far heavier than otherwise would have been the case. Surely it is high time that the Board of Trade should hold an inquiry into the methods of train lighting at present in vogue, with a view to bringing about the compulsory adoption of one which would prove harmless to the travelling public in the event of collision or derailment.

The matter has already been taken in hand in other countries, and in the Council of the Austrian State Railways a resolution was moved some time ago to the effect that the Ministry for Railways should be requested to discontinue the use of incandescent gas for the lighting of passenger trains, and to use electricity exclusively for lighting all future passenger cars, as well as those already on order. A great number of accidents had taken place, which were marked by the same feature—that fire immediately broke out, caused by the employment of gas lighting, and the lives of passengers who had not otherwise suffered by the accident were sacrificed. Since the request was made a series of tests have been carried out, showing that from the commercial as well as from the public safety point of view, train lighting by electricity presents many advantages. As a result of the tests made the Austrian State Railways largely adopted electric lighting on their trains, although from financial reasons it was impossible to convert the whole of the rolling stock to the newer system immediately. Many of the Prussian railway authorities, all the Swiss railways and the large French systems now use the electric light on their trains, and in Italy gas lighting for railway carriages is being discontinued and electric lighting substituted. In this country the whole of the tube and the underground railway trains, as well as many of the main line and suburban trains, are lighted by electricity, and there is no technical reason why it should not be adopted for lighting, heating and cooking on all the great trunk lines. That being the case, the public have a right to insist on their safety being considered in the matter, and a safe and efficient modern system substituted for one which is admittedly dangerous.

We note that, as usual, the railway company draws a red herring across the path by ascribing the fire to the live coals from the locomotive; the utter futility of this suggestion is evident to anyone who knows the construction of a locomotive fire-box, from which live coals cannot possibly be ejected. Hot ashes from the ash-pit might certainly be scattered, but there is one feature common to all these train fires—the instantaneous outburst of flame, leading immediately to a violent conflagration. It is inconceivable that so rapid and thorough an ignition should be caused by hot ashes. Without the slightest hesitation we characterise the statement as nonsensical, and declare our firm belief that, as in previous cases, the fire was started and nourished by the escaping gas. Reporting on the former accident at Hawes Junction in 1910, Major Pringle said it could not be denied that gas was the origin of the fire. In 1905 the Cudworth disaster was accompanied by a fire due to gas, and in the same year, reporting on the accident at Witham, followed by a gas fire, and that in the Catesby Tunnel, where gas escaped but most fortunately was not ignited, Colonel von Donop strongly urged the use of electricity in preference to gas. Again at Grantham, in 1906, a gas fire took place, and at Ditton Junction in 1912 there was a similar catastrophe, regarding which Lieut.-Colonel Sir H. A. Yorke recalled the recommendations of Major Pringle that electricity should be adopted and repeated them with added emphasis. Reporting on the disasters at Aylesbury, in 1906, and Saltley, 1912, the Board of Trade inspectors in each case renewed their advocacy of electric lighting. We can cite, in addition, at least a dozen instances of similar disasters due to gas lighting on foreign railways. As Col. Yorke stated in connection with the Ditton accident, the Board of Trade only awaits the support of public opinion to enable it to make the electric lighting of passenger trains compulsory. We trust that that pressure will now be applied—and in view of the unanimity with which the daily Press has attacked the system of lighting by gas on this occasion, we hope that at last something will be done to render such frightful occurrences impossible in the future.

A Chinese Contract.

THE correspondence which we publish on another page with regard to the machinery installed at the British Legation at Peking, while it explains the facts of the case, will also justify the "grave dissatisfaction" which was felt by some of the competitors for the contract. The explanation of the delay in placing the contract put forward by the Office of Works is reasonable enough; but if there was time to invite fresh prices from two of the competitors, surely there was time to request them all to submit fresh prices. That would have been in accordance with the universal practice in connection with tenders, and no reason is given to justify the plea of urgency.

The schedule of sub-contractors and their respective shares in the work certainly shows clearly that the plant is all of British manufacture, but the manner of carrying out this British contract leaves much to be desired; the supposition that work which was being carried out by a local German firm was German from start to finish was a perfectly natural inference, and in view of the importance of maintaining our prestige in the Far East, the Office of Works ought to have taken precautions to prevent any such misconception from arising. At the least an official statement should have been issued promptly, to make clear the circumstances of the case, but we are told that no such statement was published for months after the contract had been placed and the mischief had been done.

The importance of circumspection in such a matter, and of solicitude for the interests of British manufacturers, is immensely increased when the contract is of an official nature, and the adverse impression once created cannot be completely dispelled even by a prompt announcement of the facts—still less by so tardy an explanation as has been furnished in the present instance. We cannot afford to weaken our prestige in China, and it is very much to be regretted that the authorities in charge of the work so little appreciated their responsibilities to British manufacturers as to open the way to misrepresentation of the qualities of our engineering products.

D

PRESSURE REGULATION.

By C. TURNBULL, Tynemouth.

It is said that Edison declared that the best regulator was a nigger volt-boy, and for many years this dictum has been universally accepted, save that the volt-boy in Britain is a white man generally with a nigger's wages. In passing, one may note that the ordinary regulating resistance for electric generators is wasteful. Generators often are made with a wide range of voltage, sometimes giving from 400 to 560 volts to enable them to take both traction and lighting loads, and hence there is heavy loss in the resistance when the machines run at low pressures. In one actual case, the current on a 500-KW. generator is 15 amperes, and pressure drop on resistance about 200 volts, giving a total loss of 3 KW. Such a loss taking place for 9,000 hours in the year would get rid of 27,000 units, no mean figure, and in large stations these losses must come to an enormous amount. True, the cost per unit lost is not much, yet the total is quite worth consideration in almost any station. One method by which the loss might be reduced is shown in fig. 1, where the field is excited by two separate windings. The main winding is connected right across the brushes and regulation is done on a separate "teaser" winding, to borrow a word used for other purposes. The teaser winding is controlled by a "potentiometer" resistance which enables the current to be reversed. A comparatively small teaser winding is therefore required, because an increase of current in it will cause the generator voltage to rise, which will increase the current in the main field coils thus giving a compound effect, while the reversal of the teaser current will reduce the generator voltage by a large amount. This method of excitation does not appear to have been put into use, but it might be worth a trial, and would probably lend itself to operation by automatic regulators.

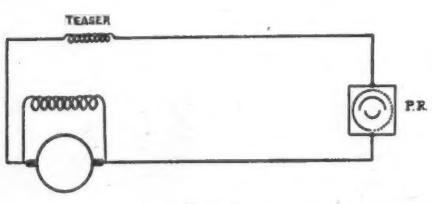


Fig. 1.

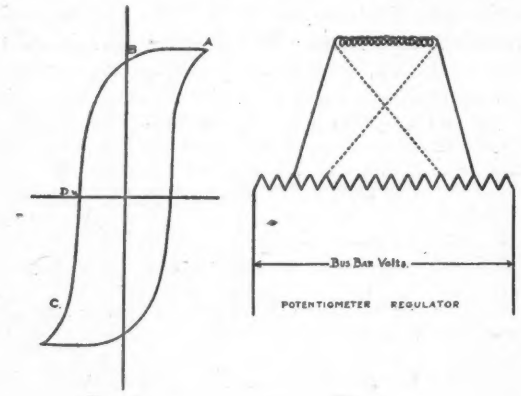


Fig. 2.

Fig. 3.

Direct-current generators are sometimes excited from a separate direct-coupled exciter, a method which is very suitable for control by automatic regulators. Compounding can be effected by one or two turns of the main leads on the exciter fields, this being economical, though having the disadvantage that the effect on the main fields would lag. A separate exciter is very necessary in the case of turbo-driven generators with compound winding on the main fields, for, when self-excited, these are liable to be driven to destruction should the supply of steam be shut off and the current come back on the generators from parallel machines, when the shunt field would disappear and the generator would run as a series motor with no load. Where a separate direct-driven exciter is used in such a case its voltage will increase with increase of speed, and so will strengthen up the main field sufficiently to limit the speed. The compound winding would, of course, be on the generator field. The separate exciter also has the advantage that it gives a more stable field where generators are worked with a long range of pressure, as self-excited machines often becomes unstable at low pressures where the iron is magnetised below the knee of the curve. The question is often asked, why not run

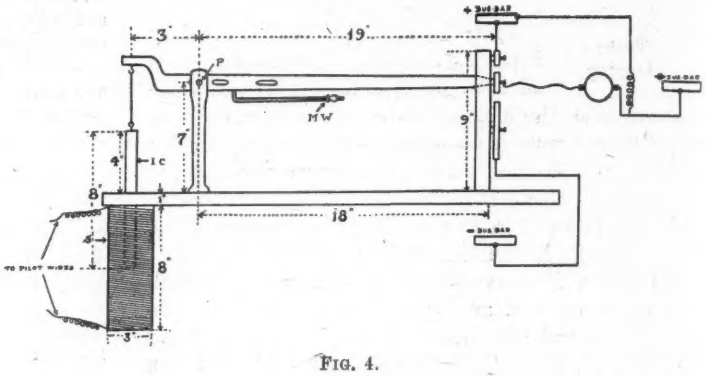


Fig. 4.

D.C. machines compound on lighting so as to steady the pressure? Certainly there are great advantages in doing this, but it introduces serious complications. The switchboard man must remember to cut out the compound coils whenever he parallels the battery in, but sometimes he forgets, and the battery current comes back on the compound coils and makes trouble. If the generators are run on traction, and there are three bus-bars for lighting, one must have equalising connections for every case, which makes a complex arrangement. Paralleling in or taking out of compound machines requires much care to ensure that current does not come back, even momentarily, through the series turns, so demagnetising the fields, while the closing or opening of the equalising switches produces disturbances on the other running generators. Taking everything into account, after several years of experience in the running of compound machines on lighting loads, the writer considers that it is a thing to be avoided if possible.

Commutating-pole generators occasionally suffer from a ripple in the voltage which produces a dithering effect on the light. This appears to be due to the time lag of the series turns, which produces a hunting effect on the series current, which in turn produces the ripple on the armature voltage. In the case of new machines it is desirable to specify that this shall be prevented. Balancers are responsible probably for most of the variation of pressure in D.C. supply; indeed, one would hardly credit the amount of variation that is due to the balancer until it is carefully looked into. It is, however, easily seen that a balancer must be sensitive when one considers that one side is acting as a motor and the other as a generator, and that there must be a considerable change of pressure with each variation of current, particularly if the out-of-balance goes from one side of the three-wire system to the other. Compound winding is particularly necessary on a balancer, but it must be applied with discretion. The usual method of compounding is to arrange that the motor field be weakened and the dynamo field strengthened, each one by its own current. With a severe rush of current the effect of this is to wipe out the motor field altogether, when the balancer stops with disastrous results to the supply. It is better to cross-connect the fields so that the motor current strengthens the

dynamo field while the dynamo current weakens the motor field, for as the motor current is greater than that of the dynamo, this gives a more stable arrangement. Probably the best method is to energise the compound coils entirely from the neutral connections, for this will enable the balancer to stand up to severe "shorts" on the mains, while the compounding can be cut out with a single switch when starting up in parallel with another balancer.

In some respects the most satisfactory method of balancing is effected by coupling the neutral to the mid-point of choking coils which are connected across slip-rings on the generator armature. Two rings may be used, joined to opposite points on the armature, so giving a single-phase connection, or three rings may be used with a three-phase arrangement, the choking coils being star connected, and the neutral led to the centre of the star, or else there may be four rings with choking coils having two-phase connections across each pair of rings, when the neutral is connected to the centre of each coil. After an experience of some years both with balancers and the choking coil method, the writer greatly prefers the latter. The pressure is much steadier than with even a compound balancer, while the convenience of operation is worth much. A comparatively raw switchboard man may be entrusted with the paralleling in and taking off of three-wire generators, while starting up after a shut-down (and such things take place in the best regulated stations) is easy, and does not require too much brain power. The generators may simply be run up on the board with all switches in, whereas in starting up with balancers one must first get a generator up to something like pressure, and then start the balancer, which cycle of operations requires some care on the part of a switchboard man flustered by the stoppage of the machines, with a feeling at the back of his mind that he may get the sack if his share in the trouble is found out.

This scheme does not enable one to adjust the pressure where feeder drops are to be compensated. People have suggested that the regulation might be effected by sliding the neutral wire to one side of the choking coil centre point, but a moment's consideration will show that this will not do, for each end of the choking coil is alternatively positive and negative, and the moving of the mid-point connection would merely produce an alternating current in the neutral wire. Regulation of pressure must be carried out by means of a mid-wire booster, but the solution of this problem is more difficult than appears at first sight, and a number of mid-wire boosters are on the scrap-heap through the neglect of simple precautions. The difficulty occurs through the fact that it is not easy to make the booster work at a very small voltage. If we consider the ordinary hysteresis curve for iron, fig. 2, this consists of a closed curve made up of approximately vertical and horizontal lines. If we apply this to the magnets of a mid-wire booster, it will be seen that we may magnetise the iron to give a small booster potential —say 3 volts one way—or may reverse it, but we cannot bring the voltage to nothing. For suppose that we are at a point A, we may come slowly back to B, without altering the potential. Then a slight further variation in the exciting current will bring us to C, but we cannot rivet the field to D. Whenever a current flows in the armature it will churn up a potential difference in the booster which will disturb the bus-bar pressure, and the booster will be unstable until the out-of-balance current is large enough to require the booster to be regulated to give sufficient voltage across its brushes to bring the field to a stable condition. The difficulty in working at low booster pressures may probably be overcome by making the air-gap very large, so that the residual magnetism of the fields will not affect the armature, while a large air-gap would reduce the effect of armature reaction on feebly excited fields. With a large air-gap, the armature would be entirely under the control of the field current, and its voltage could be made whatever was necessary. Commutating poles should be fitted to mid-wire boosters, as the armature often has to carry heavy currents with weak fields. The magnets should be compound-wound, so as to respond to sudden changes in the neutral current, the series turns being shunted by a variable resistance, while the fine wire shunt coils will enable the pressure to be adjusted accurately. These should be controlled by a "potentiometer" resistance which enables the booster voltage to be reversed, as shown in fig. 3. (For those who may not be familiar with potentiometer regulators, one may add that in this method of working, a resistance is connected across the bus-bars, corresponding to the potentiometer slide wire, and the fields are excited by being connected to suitable parts of same. The field may be reduced to zero by connecting both ends to the mid-point of the resistance, while reversal of field may be obtained by connecting as shown by dotted lines.)

A Cheap Automatic Regulator.—Many interesting and useful regulators are now on the market, but some of the best require a motor-generator to enable the fields of the main generators to be controlled, and this means expense. The following automatic regulator, shown in fig. 4 (for the main part of which the writer is indebted to Mr. S. J. Watson, of Bury) is cheap, simple and reliable, and may be made in the station at small cost. Of course, it is not so quick acting as a Taylor-Scotson or Tirrill, but it is much better than a switchboard man. The regulator consists of an arm, pivoted at P, from one end of which hangs an iron core, I C, which is attracted by the solenoid S. An old Schattner prepayment meter has very suitable parts which may be used with advantage. The solenoid is excited by pilot wires from the feeding point, thus compensating for feeder drop. Lamps in series control the current in the solenoid to the desired amount.

Regulation of pressure is effected by the moving weight M W, which should preferably be a nut and check-nut on a screwed spindle. The dimensions shown are from an actual regulator which is working satisfactorily. In this case the core is made up of soft-iron tubes out of an old arc lamp, the tubes being filled up with "stalloy" filings, which combination is free from hysteresis. It is important to use a core of good iron, as iron affected by hysteresis will cause the core to stick until the pressure has altered by a considerable amount, when it will suddenly move up or down

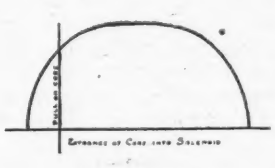


FIG. 5.

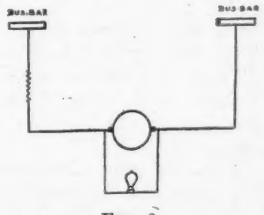


FIG. 6.

until the pressure has altered again, and it will continue doing this without ever settling to one position, causing the bus-bar voltage to hunt in a distracting manner. It is important also to get the core immersed in the solenoid to a proper degree.

The pull of a solenoid on a core appears to vary somewhat according to the curve in fig. 5; that is, if the core is entered but a short way, the pull will increase if it be drawn in a little further, simply through its change of position, while if it be withdrawn slightly it will tend to come out altogether. The core will, therefore, be unstable, and unable to control the regulator. When it is about half way in, the pull will have come to the flat part of the curve, when a slight change of position will not affect it. The pull on the core will now depend entirely on the solenoid current, and the regulator will work accurately. (Incidentally, one might suggest that the control of arc lamps would be improved if their cores and solenoids were arranged on this principle.) The core should be the same length as the solenoid to get good results. From the diagram it will be seen that the contacts on the end of the lever connect the regulator motor to either positive or negative bar, the other side of the motor being connected to the neutral bar. As the fields are permanently excited, the motor will rotate one way when the solenoid pulls the core down, thereby bring the lever contact to the top contact, while it will rotate the opposite way when the lever moves downwards to touch the bottom contact. The contacts are arc lamp carbons made of very pure carbon, which does not form slag, and, with weekly

cleaning, they may be depended on to work without trouble.

Lamps, in series with the motor, limit the current to what is necessary. A no-load cut-out is in series with the armature, to switch off the motor if current should go off the pilot wire for any reason, otherwise in such an event the motor would run until all resistance was cut out of the regulator so raising the bus-bar voltage to a dangerous extent. The no-load switch may be connected up to a bell if desired, which would give warning if the switch were to act. The motor may control either the main regulator, or it may actuate a subsidiary resistance in series with the main regulator. This latter is convenient in that it can be changed from one generator to another in a few minutes. The motor may actuate the regulator either by cords or belts, or it may be direct coupled through a worm gear.

In the last case, a reduction of at least 200 to 1 is desirable so that the motor will make two or three revolutions for each regulator step. Contacts should be arranged to check the motor should the switch blade run too far round so as to come against the stop; these contacts are connected to rotate the motor in the opposite direction, the result being that the motor stops as soon as the current gets through them, and it comes back a little as soon as the regulator contact allows it.

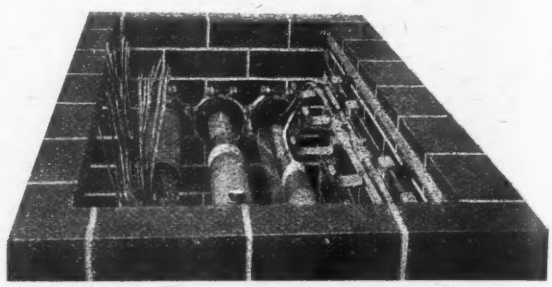
The speed of the regulating gear must be adjusted to give good results, and for this it will be found that the gear should either work very quickly or rather slowly. There is a considerable lag in the magnetic field of large generators, which is compensated for in instantaneous regulators by overshooting with a subsequent settling down to the correct position. A medium-speed regulator will continually overshoot the mark, but will not be rapid enough to settle promptly to the correct position and this will cause hunting, but a somewhat slow movement of the apparatus will prevent it from overshooting far enough to get very far from the normal position, and this will enable it to adjust the voltage without hunting. Where it is necessary to reduce the speed of the motor, it is not sufficient to put more resistance in series with the armature as this will unduly weaken the torque. In such a case one may put a lamp across the commutator, as shown in fig. 6, which will not divert any current at the moment of starting up, but will shunt the current as soon as the armature rotates and produces a back E.M.F. This arrangement reduces the motor speed in a very effectual manner, having the same effect as a dash-pot.

Power of Motor.—The power of the motor depends on the gear ratio, the efficiency of the gearing and the stiffness of the regulating gear. An admirable epicyclic gear has been put on certain remotely controlled regulating resistances by a German firm, and this is worked by a motor of ¼ H.P., or less, but the saving in the cost of the motor might be balanced by the cost of the gear if it had to be specially made up. To ensure starting power with a gear ratio of 200 or higher, a motor of about 1 H.P. will be found suitable.

ELECTRICITY AT THE GHENT EXHIBITION.

WHILE the British Section, as a whole, at the Ghent Exhibition compares favourably with the Sections representing other nations, it cannot be said that the Machinery Hall offers many features of interest to electrical engineers; by far the most important exhibits are those of two famous manufacturers of textile machinery, namely, Messrs. Fairbairn, Lawson, Combe, Barbour, Ltd., of Leeds and Belfast, and Messrs. Platt Bros. & Co., Ltd., of Oldham, and while great credit is due to these firms for their magnificent displays, we can only add that the machines are electrically driven by well-known methods, and, for us, *voilà tout!* A noteworthy feature of the exhibition is the prominent part played by Government departments, which occupy a large proportion of the space, to very good purpose; in particular the work of the National Physical Laboratory in connection with aviation is well illustrated in the Machinery Hall, and the whole of an adjoining bay is devoted to Postal Administration — the latter being the largest exhibit in the British Section, and including every branch of the many services controlled by the Post Office.

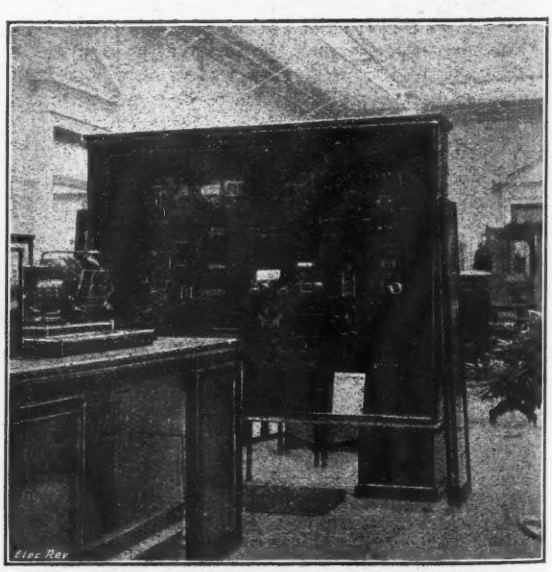
The whole of the motive power used in the British Section is supplied by electricity, both D.C. and A.C. being available. The mains were laid throughout by the Exhibitions Branch of the Board of Trade, under the supervision of Mr.



JOINTING CHAMBER, SHOWING P O METHOD OF BONDING PIPES AND DISTRIBUTION.

Marchant, electrical engineer to the Branch; the Department also laid the foundations for the machinery exhibits, dug trenches, provided the floor and railings of the stands at a moderate charge, and furnished free signboards and free labour for unloading the exhibits. Most of the cables were run on insulators, but on the stands they were enclosed in screwed steel conduit. Bergmann tube was found very useful for making connections to motors, starters, &c., owing to the ease with which it can be bent and shaped to suit the needs of each case.

The Exhibition Committee provides a supply of three-phase alternating current at 6,000 volts, which is received in a detached sub-station outside the Machinery Hall, and transformed to 216 volts between phases. The Board of Trade has installed inside the Hall a 300-KW. rotary converter, made by the BRITISH WESTINGHOUSE E. & M. CO., LTD., which enables a D.C. supply to be given at 440 volts on



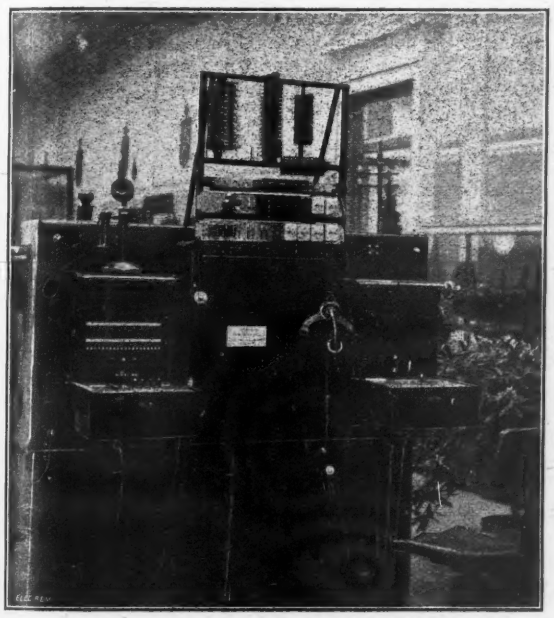
WESTERN ELECTRIC CO.'S DEMONSTRATION BOARD IN P.O. EXHIBIT.

the three-wire system; energy is charged for at cost price, the Board paying the costs of transformation. The converter is of special interest in that it is of the new Rosenberg self-starting and self-synchronising type; we were informed that

the operation of starting and synchronising could be accomplished within 15 seconds, with ease and certainty. The 6,000-volt A.C. is transformed down to 310 volts for the converter by a Westinghouse oil-insulated water-cooled transformer of 330 K.V.A. The converter is of the six-phase type, with six poles, and runs at 1,000 R.P.M.

The plant in the Board of Trade sub-station includes a switchboard by Messrs. Ferranti, Ltd., of their latest type; this controls the supply to and from the rotary converter, the switchgear being mounted on black enamelled slate slabs carried on an iron frame. The main circuit-breakers are of the relay type, with inverse time element overload release. The equipment includes switches and meters for the control of three feeders, and the whole constitutes an admirable and typical exhibit of the company's standard switchgear. Messrs. Ferranti also exhibit a standard 6,000-volt three-phase ironclad switch panel suitable for use on consumers' premises, the doors being interlocked with the switchgear in a most complete fashion.

The principal engineering exhibit, apart from the textile machinery, is that of Messrs. Vickers, Ltd., together with the Electric and Ordnance Accessories Co., Ltd., and the Wolseley Tool and Motor-Car Co., Ltd. A Stirk 25-ton planing machine, driven by a 25-H.P. Vickers motor, is a prominent feature of the exhibit; other machines shown at work are a Greenwood & Batley turret



Peel-Conner Telephone Demonstration Board.

lathe driven by an 8-H.P. Vickers motor, and Archdale radial drills driven by 8 and 10-H.P. motors, with the Vickers standard heavy-duty control pillars.

The Stirk planer is equipped with the Vickers reversible drive and a motor-driven lift for the tool-holders. A Muir slotting machine for heavy work, driven by a 20-H.P. motor, is also shown at work. Vickers vanadium steel tools, and the firm's expanding reamer and a locking drill (with which the drill can be changed without stopping the machine) are other items of the exhibit. The Electric and Ordnance Co. show, besides their motors and controllers, a collection of electrical cooking apparatus, switchgear and ventilating fans; the last-named are driven at 24 volts from the train-lighting plant, which we shall describe in a later issue.

Messrs. R. A. Lister & Co., Ltd., exhibit their "Lister-Bruston" automatic electric lighting plant for country houses, for 40 12-C.P. lamps, with which our readers are familiar.

Messrs. W. J. Bates & Co., Ltd., Denton, showed their suction-gas, town gas and semi-Diesel oil engines, and Messrs. E. H. Bentall & Co., Heybridge, their petrol engines.

The British Post Office exhibit occupies an entire court, 110 yards long by 16 yards wide. Here have been assembled examples of all that is "Postal," a term which embraces telegraphs, telephones, carriers, recording apparatus, sorting tables, uniforms, postal orders, money orders, and apparatus and tools of almost every description used in the many departments of the Post Office.

The telegraphs are exceptionally well displayed, and form one of the most attractive exhibits. The apparatus is so arranged as to enable a visitor to withdraw a telegram form from the automatic box, write out the message and witness its transit by all the latest devices in general use in the British Post Office until it is delivered to the point where the messenger starts off to take it to its destination. A pneumatic tube worked by the maintenance of a low vacuum, and having a section of glass tube to show the carrier passing, would carry the message to the instrument room, where the A.B.C. instrument or any of the intermediate telegraphic contrivances up to the set of quadruplexed Baudot apparatus might be used to carry it onwards. A Helsby cord carrier or the Lamson "pick up" carrier takes its allotted part in the imaginary journey.

Double plate sounders, omnibus sounder circuits, duplex, quadruplex, Hughes, and Wheatstone sets are kept constantly working, whilst miles of Morse slip are run off by the Siemens motor-driven Wheatstone sets, and suitable phrases are carried away by visitors as souvenirs. The Gell perforator and the Oliver typewriter appeal to those who are familiar with the Morse code.

Water-level apparatus by Messrs. Gent & Co., illustrating the registration of the variation in the water level of a reservoir, and secret-service house telephones by this firm, are exhibited in working order; and the whole Court is clocked by a beautifully wrought turret clock with four dials controlled by a master clock supplied by the Silent Electric Clock Co.

Telephones are mainly represented by the working exhibits of the Western Electric Co. and the Peel-Conner Co.; their demonstration boards illustrate the latest types used for manual telephone exchange equipments, arranged in the form of model "A" and "B" operators' positions, which illustrate exactly what happens from the time the receiver is raised until the talk is finished. A variety of telephone parts and cables are also displayed by both these firms, in suitable cases.

Automatic telephone parts are placed in position for convenient examination, and a most interesting item, the step by step transmitter (Wheatstone, 1839), which is practically the same idea as the present automatic calling device, is conveniently near.

Telegraph poles, arms, and creosoting plant, and the chemicals resulting from the use of creosote, are shown by Messrs. Burt, Bolton & Hayward. Examples of the methods of terminating and protecting overhead wires, and also the latest devices for connecting paper-insulated cables to other types, and protecting underground cables from stray power circuit currents, and how the insulation of paper-covered cable is maintained by desiccating machinery, are fully illustrated.

Testing apparatus as used in the Post Office is grouped together; the latest Post Office testing device, known as Hay's fault locater, has a place of honour just beyond the automatic apparatus.

Postal items from a packet of pins to mail bags for Hong-Kong, with a thousand and one odds and ends, are arranged to catch the eye, whilst gold badges, coloured armlets and various good conduct stripes are freely patterned around; clever pictorial cartoons, show how the youth and his maid deposit their shilling or the contents of the home safe, with the Savings Bank, and what becomes of it; and in a similar manner the Money Order Department illustrates its work, and shows samples of the earliest money orders, and also those used for the payment of old age pensions.

Mansbridge's condenser winding machine in working order is another attractive item, with its huge reels of metal-covered paper.

The Board of Trade were wise in inviting the Post Office to take space, and certainly the Post Office officials are to be heartily congratulated upon the very complete exhibit they have assembled. Many old and familiar features are

included, but they are none the less welcome; probably the best known and most travelled veteran is the famous woodpecker, without which no Post Office exhibit would be complete.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Tariff Reformula.

As a consumer of energy exceeding one million units per annum, taken from the mains of 15 supply authorities, I have to look after the pence that the pounds may take care of themselves.

On a recent afternoon, when carefully considering the "scientific" tariffs by which various "Managers" extract 1·52d. per unit out of me, viz., the maximum damned, the discounts, two-rates, sliding scales, rateable values, fixed charge per kilowatt of maximum demand, telephone, and various other *systems*, it occurred to me that a simple formula like the following, which every consumer could easily understand, would automatically combine all the present systems :—

Price per unit =

$$\frac{1}{\int_0^{p/2} \mathrm{T} \max \sin \psi \times \mathrm{M} \sin(\psi - \phi)\, dt\, \mathrm{B}^{x^n}}{\frac{3}{2}\sqrt{\mathrm{E}} \max \mathrm{F} \max \psi \sin(\psi - \phi)\, d\psi.}$$

Where T = time wasted in endeavouring to persuade consumer that the penny units are too strong when taken unadulterated, and must be freely mixed with the fivepenny ones; B = business lost to dissatisfied consumer; M = myster(y)isis of the demand indicator, a constant depending on the type of consumer; E = eddy currents circulating in the brain of the consumer after x^n hours' discussion with sales manager; F = the flux density of perspiration beads at the expiration of above period. (It is well to note that practically all the quantities are at a maximum value, as is indicated by balances paid to relief of rates, while 4½d. per unit is charged for lighting and 2d. for power in a few of our "modern" (!) business centres.)

Good luck to the Point Fives! May their lums reek lang!

Erg.

The Status of the Shift Engineer.

I notice on reading a report of the Holt Parliamentary Committee, who have been sitting on the question of Post Office servants, that one of the recommendations is that shift engineers, switchboard attendants, fitters, drivers and stokers shall all be classed as "skilled workmen."

If I remember rightly, the account of the G.P.O. electricity undertaking, which appeared in your excellent journal a year or two ago, proved this to be a thoroughly up-to-date E.H.T. system of considerable capacity.

I consider that to class as a "workman" a man who is responsible for the running of a shift in such a station is an insult to the profession, and can only be due to a lack of knowledge of the duties performed, and the engineering training required by a shift engineer.

At the present time, as proved by your "Correspondence" columns, shift engineers and switchboard attendants all over the country are asking for something more than a bare living wage, as their responsibilities, training and social status entitle them to do, and one naturally expects a Government Department to take a lead in these matters, by giving those doubtless efficient and capable men the rating that is due to them.

I maintain, and I am sure all other members of the profession will join me, that it is "up to" the Engineering Department of the G.P.O. to see that this is done.

Once a Shift Engineer.

It will be gratifying to many of those gentlemen who have recently ventilated their opinions upon the status and qualifications of central-station engineers, to learn the views of the Post Office Select Committee upon this matter. This body advises the Postmaster-General to rank shift officers as Class I, skilled workmen, and switchboard attendants as Class II. Fitters are to be divided between the two classes, whilst enginemen, stokers, &c., are to fraternise with switchboard attendants in Class II.

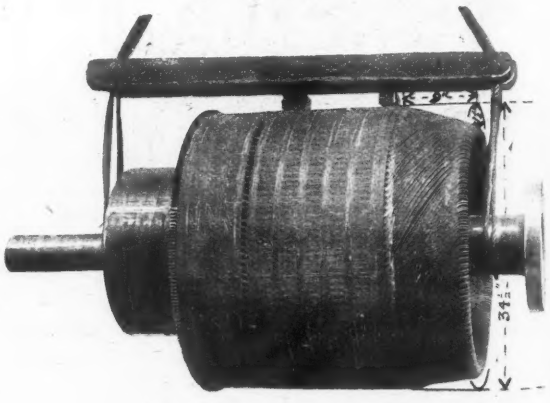
The writer has no personal knowledge of the staff, but as charge engineers and switchboard attendants were selected for the new Post Office electricity scheme but a few years ago from hundreds of applicants, it necessarily follows that the successful men must number in their ranks college, works and central-station trained engineers.

When a Government Department fails to recognise the fact that its responsible servants have entered an honourable profession in the hope of securing that monetary profit and social respect to which their training and position entitle them, how can municipal and private concerns be expected to treat their engineers with courtesy and justice?

Engineer.

Collapse of End Winding of a D.C. Armature.

Herewith photograph of armature of a 200-KW. 440-volt shunt-wound D.C. generator, showing the collapsing of the end overhanging winding nearest coupling. The original diameter of the armature at this end was 34½ in., and it has been collapsed to 31¼ in. The accident was brought about in the following way: the machine had been taken off load a few minutes previously, and was just on the point



of stopping, when the switchboard attendant accidentally closed the main switch again. As the machine was not fitted with reverse circuit breakers, but only with heavy copper links, a momentary heavy current passed—estimated from the section of the copper links which were fused at 7,000 amperes. The capacity of the other D.C. generators on load in the station at the time was 2,200 KW.

The collapsing is remarkably uniform, and the insulation remains nearly intact, as can be seen from the photograph. The commutator was only slightly damaged, due probably to its being in slow rotation at the time. I should like to know whether any of your readers have come across a similar occurrence in low-pressure generators.

F. W. W.

Olympic Games, Berlin, 1916.—The Duke of Westminster has opened a special fund, and will be glad to receive, and acknowledge personally, any donations, large or small, that may be sent to him at Grosvenor House, London, W., in support of the National appeal for £100,000, which was signed by Lord Grey, Lord Harris, Lord Roberts, Lord Rothschild, Lord Strathcona, and himself. Cheques and envelopes should be marked "Olympic Fund." The objects of the fund are not only to enable Britain to play her proper part in the Olympic Games at Berlin in 1916, but also to encourage amateur sports and athletics, and to raise the standard of physical efficiency of the youth of the nation.

RULES FOR INSULATED CONDUCTORS.

The 1912 German rules governing the construction, testing, and application of various classes of insulated conductors are so definite and instructive that readers will doubtless be interested in the following abstract, in which much of the repetition necessary in the original has been avoided, while the lengthy tables have been much curtailed.

I.—Rubber-Insulated Conductors; Not Tested under Water.

Class G B. includes rubber-taped conductors, suitable for permanent installation over plaster in dry rooms, for pressures up to 125 volts. Solid cores are permissible from 1 to 16 sq. mm., and stranded cores from 1 to 50 sq. mm. may be thus insulated. In constructing this class of wire, the copper core is hot-tinned, covered with cotton and over-wound with pure Para rubber, successive turns of which must overlap by not less than 2 mm.; the conductor is completed by a covering of cotton, and a braiding of cotton, hemp, or equivalent material which is impregnated according to standard rule. No puncture test is required, but the following table (abstract) must be satisfied :—

Copper section sq. mm.	Minimum number of wires in multiple conductors.	Minimum grams of Para rubber per metre run
1·0	7	1·30
10·0	7	3·40
25·0	7	5·50
35·0	19	6·50
70·0	19	10·00
150·0	19	15·00

The above weights to be the average of five 1 m. samples from different parts of coil.

Class F.A.—This grade is suitable for installation in and to lighting fittings up to 250 volts. A solid or stranded copper conductor of 0·5 sq. mm. section is hot tinned and covered with vulcanised rubber 0·4 mm. thick, and a braiding of cotton hemp or silk, &c., which may be impregnated. This type of conductor may be twisted to make double or triple cord, either before or after braiding. The rubber covering must have at least 33·3 per cent. caoutchouc (containing not more than 6 per cent. resin), and must not contain more that 3 per cent. of organic material (Zeresin). The specific gravity of the core rubber must be not less than 1·5. Lampholder conductors must, when dry, withstand 1,000 volts, A.C., for 30 minutes. In testing a single core type two 5-m. length are to be tested together.

Class P.L. includes pendant cords for pressures up to 250 volts. Copper wires of not more than 0·3 mm. diameter are tinned and stranded together to a total wire section of 0·75 sq. mm. The conductor is covered with cotton and not less than 0·6 mm. of vulcanised rubber. Two cores are twisted together with the inclusion of a tension cord and the whole is braided. If a metal tension wire be used, it must be cotton-covered or braided with other insulating materials. The component parts of the cord must be so arranged that the outer braiding is not depended upon to hold them in place. Cord for adjustable fittings must be so flexible that single cord can be bent round 25 mm. rod and double cord round 35 mm. rod without injury. The finished conductor must resist 1,000 volts, A.C. test pressure for 30 minutes when dry.

II.—Rubber-Insulated Conductors: Tested under Water.

Conductors in this group are insulated with vulcanised rubber which must fulfil the above specification. The conductor itself is copper, hot tinned. After 24 hours' soaking, the conductor must withstand, for at least 30 minutes, the following A.C. test pressure between the copper core and water, at a temperature not exceeding 25° C. :—For working voltages of 1,000—4,000 volts, the test pressure = 2 × the working pressure. For higher working voltages, the test ratio gradually decreases to 1·5 for working pressures of 10,000—12,000 volts.

Class G.A.—Includes conductors suitable for use up to 1,000 volts in permanent installations and up to 500 volts in portable circuits. The copper section ranges from 1 to 16 sq. mm. (solid), or from 1 to 1,000 sq. mm., if stranded. The minimum number of wires in stranded conductors of various sections and the minimum thickness of rubber are as follows :—

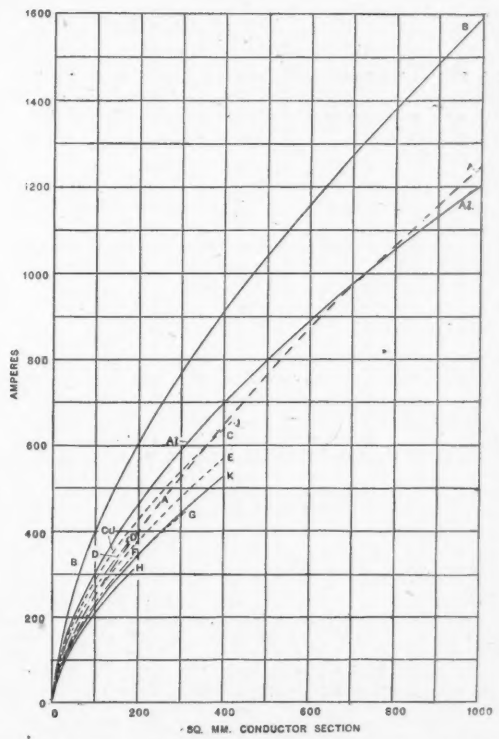
Copper section sq. mm.	Minimum No. of wires in stranded cable.	Minimum thickness of rubber. Class G.A. mm.	Class S.G.A. mm.
1·0	7	0·8	1·5
25·0	7	1·4	2·0
35·0	19	1·4	2·0
95·0	19	1·8	2·6
120·0	37	1·8	2·6
185·0	37	2·2	3·0
240·0	61	2·4	3·2
400·0	61	2·8	3·6
500·0	91	3·2	4·0
625·0	91	3·2	4·0
800·0	127	3·5	4·5
1,000·0	127	3·5	4·5

The rubber is covered with rubber tape and impregnated cotton or hemp; in multiple conductors a common braiding may be employed.

Class S.G.A.—This is a special grade of G.A. suitable for any permanent installation and for portable apparatus up to 1,500 volts; the rubber covering must now consist of several layers, to a total thickness not less than that shown in the table. Otherwise the stipulations for class G.A. again apply.

Class S.A.—This class includes rubber-insulated cords suitable for the same pressure ranges as Class G.A. The permissible rubber section ranges from 1 to 6 sq. mm., the rubber strands must not be more than 0·3 mm. diameter. The stranded conductor is cotton covered, sheathed with water-proof vulcanised rubber, which in turn is covered with yarn, silk or cotton. Round or oval multiple cords under an outer braiding, in addition to the covering on each core. The minimum thickness of rubber is 0·8 mm. for conductors of 1·5 sq. mm. or smaller section, and 1·0 mm. for larger conductors up to 6·0 sq. mm.

Class P.A.—This is S.G.A. wire with a braided or spiral metal armouring. The impregnated braiding for S.G.A. conductor must be replaced by an equivalent covering, which will also prevent the penetration of broken armouring. The armoured conductor may



Curve A, rubber-insulated copper cables. Curve B, single-core; 700-volt maximum, lead-sheathed copper. Curve C, twin-core; 3,000-volt maximum, lead-sheathed copper. Curve D, twin-core; 10,000-volt maximum, lead-sheathed copper. Curve E, three-core; 3,000-volt maximum, lead-sheathed copper. Curve F, three-core; 10,000-volt maximum, lead-sheathed copper. Curve G, four-core; 3,000-volt maximum, lead-sheathed copper. Curve H, four-core, 10,000-volt maximum, lead-sheathed copper. Curve J, concentric, two-core; 3,000 volts, lead-sheathed copper. Curve K, concentric, three-core, 3,000 volts, lead-sheathed copper. Curve Al, single-core insulated aluminium cables 700 volts.

Fig. 1.

be used up to 1,000 volts in permanent, and up to 500 volts in portable installations, and must, when dry, withstand 4,000 volts A.C., between core and armouring.

Class B.L.—No "Normalien" are applied to this class, which includes portable conductors for cranes, pit sinking, blasting, and so forth, but the following general recommendations are made :—Any rubber-insulated wire of suitable grade may be used, providing it is braided or armoured suitably. The conductor is to be stranded, and must contain as few joints as possible. At joints, the wires are to be separately soldered together, and the individual joints are to be so displaced that the flexibility and strength of the whole is affected as little as possible. For pressures below 250 volts the smallest permissible copper section is 2·5 sq. mm., for higher pressures no testing or auxiliary wires must be used in the cable, the copper section of which must be at least 6 sq. mm. In the latter case the conductor should be of class S.G.A., metal armoured. The diameter of individual strands must not exceed 0·8 mm. in conductors of total copper section = 50 sq. mm. or less. In larger conductors the diameter of strands must not exceed 1·2 mm. In the case of aerial lines, a special tension core, or the armouring may be depended upon for mechanical strength, and the total weight of the span must be carried with a factor of safety not less than 5. An impregnated fibrous covering must be provided, in addition to the braiding between the conductor cores and the armouring or tension core. If an earthing wire is used (Class B.L.E.), its section must be at least 4 sq. mm., and its use does not enable the armouring to be omitted from conductors otherwise falling under Class B.L.

TABLE A.—Constructional Data for Single-Core D.C. Lead-Sheathed Cables.

Copper core.			Minimum thickness internal insulation.* mm.	Thickness of lead sheath.		Thickness of covering over lead.† mm.	Thickness of strip armouring.‡ mm.	Thickness of covering over armour.§ mm.	Approx. overall diam. cable.	
Square mm.	Minimum No. wires. Without test wire.	With test wire.		Single. mm.	Double. mm.				Without test wire.	With test wire.
1-2·5	1	—	1·75	1·2	—	1·5	—	1·5	17-18	—
4-10	1	—	1·75	1·4	—	1·5	—	1·5	19-20	—
16-35	7	3-6	2·0	1·55	2×0·9	2·0	2×0·8	2·0	25-26	26-27
50-95	19	6-13	2·0	1·6-1·7	2×1·0	2·0	2×0·8	2·0	29-32	30-33
120-185	19-37	13-26	2·0-2·25	1·8-2·0	2×1·1	2·0-2·5	2×1·0	2·0	35-40	36-41
240-400	37	29-36	2·5	2·1-2·3	2×1·2	2·5	2×1·0	2·0	43-49	44-50
500-1,000	37	36	2·75-3·0	2·4-3·0	2×1·3-1·5	3·0	2×1·0	2·0	54-67	55-68

* Good impregnated paper of fibrous material. † Good impregnated paper or acid-free impregnated jute. ‡ Wire = 1·8 mm. galvanised iron. § Good impregnated, acid-free jute. Test wire copper section to be 1 sq. mm. throughout.

III.—Lead-Covered Cables.

(*a*) *Rubber-insulated* conductors of Class G.A., or S.G.A., are individually braided, twisted together, covered with impregnated tape, lead-covered and armoured. The insulation tests are as outlined in Sec. II, and the current loading permissible is given in tables below.

(*b*) Single core D.C. lead-covered cables, with and without earthing wires (up to 700 volts), are subject to the above constructional regulations, and must obey cols. 1 to 5 (Table A), for bare lead cables; cols. 1 to 6 for asphalted cables; and cols. 1 to 9 for armoured and asphalted cables. For all three types, the testing pressure is 1,200 volts A.C. for 30 min. If aluminium is employed, the conductor section must be at least 4 sq. mm.

(*c*) *Concentric and Twisted Multicore Lead Cables.*—The rules cover paper or fibre cables for pressures up to 3,000 volts. The size of wires forming the outer conductor in concentric cables must not be less than 0·8 mm. diameter, but, subject to these restrictions, should be such that this conductor is as nearly as possible a closed ring (viewed in section). If aluminium is used, the minimum permissible section is 4 sq. mm. Tables are given in the rules fixing the minimum number of wires in the cores of these cables and fixing the minimum insulation between cores, and between cores and sheath. The alternating testing pressure is to be double the working pressure, applied for 30 min. at the works, and 1·25 × the working pressure applied for 1 hour after laying. Three-phase current may be used to test three-core cable. The following table shows in abstract the dimensions fixed for lead covering and armouring:—

Diam. cable under lead sheath (mm.).	Thickness of lead (mm.). Single.	Double.	Thickness of spun covering on lead (mm.).	Thickness of strip armouring (mm.).
10 — 18	1·5 — 1·8	2 × 0·9 — 1·1	2	2 × 0·8
20 — 35	1·9 — 2·4	2 × 1·1 — 1·3	2·5	2 × 1·0
38 — 70	2·6 — 3·6	2 × 1·3 — 1·8	3	2 × 1·0

(Thickness of covering on armouring = 2 mm.)

Permissible Current Densities.—(*a*) In rubber-insulated conductors the highest permissible current density per sq. mm. ranges from 15 amperes (0·5 sq. mm. wire) to 3·57 amperes (35 sq. mm. wire), and 1·25 amperes in 1,000 sq. mm. wire. Higher loading may be adopted in intermittent service providing the temperature rise does not exceed that which follows from the above continuous ratings. The highest permissible sustained current in fuses is 1·25 × normal current. (*b*) The permissible densities in lead cables in earth are shown in fig. 1. The current density is from 4 to 8 per cent. lower in 10,000-volt than in 3,000-volt cables of equal section. If the cables are in air, in ducts or grouped together in earth, the current densities allowed by fig. 1 should be reduced 25 per cent. The curves assume cables to be laid about 70 cm. deep, not more than two cables in one trench and a temperature rise of about 25° C. Colliery cables laid along galleries may be considered as laid in earth.

(*c*) *Insulated Aluminium Cables.*—As will be seen from fig. 1 (Curve Al), the permissible density in an insulated aluminium cable is about 23·5 per cent. lower than in the equivalent copper single-core lead-covered D.C. cable laid in earth. The highest permissible sustained current density in a single core D.C. aluminium cable for pressures up to 700 volts, laid in earth, range from 10·5 amperes per sq. mm. (in 4 sq. mm. conductors) up to 4·0 amperes in 50 sq. mm., and from 1·25 to 1·6 amperes in conductors of 1,000 to 500 sq. mm. effective section.—R. E. Neale.

TRADE OF SOUTH AFRICA.

The following are extracts from a report on the trade of South Africa by H.M. Trade Commissioner at Cape Town, just issued by the Board of Trade, to which we refer in our leader. Copies of the report itself may be obtained from Messrs. Wyman & Sons, the price being 6d.

British Trade with South Africa.

The following table gives the value of imports of general merchandise from the United Kingdom into South Africa from 1907 to 1912:—

Year.	Value.	Percentage of total imports.
1907	£14,331,654	56·75
1908	13,313,289	56·19
1909	15,206,317	58·09
1910	20,048,158	59·05
1911	20,328,209	58·29
1912	20,850,970	58·03

It will be seen that there have been slight variations in the percental position of the imports from the United Kingdom in relation to the total imports of the country, but slight variations from year to year have no special significance. It must be remembered that the trade of the United Kingdom with South Africa is composed almost entirely of manufactured articles, and this fact must be borne in mind in considering any slight fluctuation in our percental position. The character of the imports of other countries cannot be disregarded in an attempt to gauge the relative standing of competing countries from year to year, especially in dealing with the trade of a country like South Africa, which imports such large quantities of non-competitive goods. The arrival of important shipments of timber, coffee, nitrates, rice, grain, butter, paraffin, &c., within a certain statistical period has a considerable effect on the total value of the imports, and thus introduces a disturbing factor in regard to the percental position of countries not concerned in supplying such articles.

The trade of South Africa may be divided into three classes, viz. (1) goods in which British trade is more or less supreme; (2) goods in which we hold our own though encountering keen competition; and (3) goods in which we are behind our competitors. In class 2 are included electric wires and cables, in which Germany is our only rival; and electric fittings and parts, in which Germany and America are both keen competitors, but particularly the former.

Electrical machinery is placed in Class 3, Germany holding a very strong position, and her imports being nearly double those from the United Kingdom; the United States is also a keen competitor.

American Competition.

The United States has considerably improved her position on the 1907 figures, as well as on those for 1911. The imports from the United States for the last six years have been:—

Year.	Value.	Percentage of total imports.
1907...	£1,991,119	7·89
1908...	1,941,154	8·19
1909...	2,115,236	8·08
1910...	2,663,086	7·85
1911...	2,828,025	8·11
1912...	3,233,396	9·00

I attach greater importance to United States competition than I do to that of Germany, though it must be remembered that, in addition to supplying manufactured goods of a competitive character, the value of the imports from the United States is considerably swollen by the shipment of natural products and non-competitive commodities, such as paraffin oil, paraffin wax, motor spirit, and raw timber, which together amount to a fifth of her total trade with South Africa. There is no doubt that the United States trade under a material advantage, in that their manufacturers have had to deal in their own country with very similar conditions to those which prevail in South Africa. They thus start equipped with the experience which British firms have to acquire by patient study and by experimental work. Moreover, in many cases, they simply have to increase the output of an article already in use in their own country, which at once meets similar requirements in this country. This, undoubtedly, has accounted largely for their success in all classes of agricultural implements and appliances, water-boring machinery, and fencing material, and it is now assisting them, to a great extent, in the motor-car trade.

Not only is their competition to be feared on these lines, but workshop practice and the vigour of their oversea selling arrangements make the United States a dangerous rival.

German Competition.

The values of the imports from Germany for the last six years have been :—

Year.	Value.	Percentage of total imports.
1907	£1,923,085	7·61
1908	2,048,523	8·65
1909	2,367,373	9·04
1910	3,512,909	10·35
1911	3,411,376	9·78
1912	3,230,021	8·99

It is thus seen that in the six years Germany increased her trade by £1,306,936, or 67·96 per cent. But it is of importance to note the steady rise which took place in her trade between the years 1908 and 1910, and the equally steady drop since 1910. This I attribute very largely to the starting up and the gradual completion of the contract for the erection of the enormous electric power stations on the Witwatersrand by the Victoria Falls and the Rand Power Companies.

I may be allowed to recall the comments contained in my report for the year 1910 in this connection :—

"In estimating the extent of Germany's competitive enterprise, both now and in the future, it must be remembered that the execution of the contracts referred to is a purely temporary matter, and that the present increase of German imports into South Africa cannot be regarded in the nature of a permanent growth, or the normal condition of her trade."

Subsequent events have, to a great extent, confirmed this statement, in that while the imports of electrical machinery and requirements from Germany increased by an amount of £719,000 between the years 1907 and 1910, in the last two years they dropped to the extent of £412,000, and one may reasonably anticipate a still further reduction. Her normal position, however, will not be reached until the contracts are wholly carried out.

But I have no desire whatever to make light of the vigour of German competition. On the contrary, it threatens us on many sides, and German manufacturers respond readily and eagerly to the requirements of South African buyers. They, moreover, take great pains in the selection of suitable agents ; they pay them well, and support their efforts in a ready fashion. German firms are ever willing to adapt their goods to the wants of individual merchants, and they give prompt delivery. They also never fail to include in their packages attractive samples of numerous other goods which they are capable of supplying. This unsolicited distribution of samples must certainly cost money, but it pleases, and very often results in the placing of initial orders. There is a determination and a thoroughness about German commercial methods which is deserving of imitation.

In addition to the efforts of individual manufacturers, German trade is greatly assisted by the well-organised Governmental aid connected with the export business of that country. I refer to the low rates at which the German State railways carry goods for export, and the advantages offered by their "through rates" (rail and sea), which are utilised in quoting prices to South African merchants, which, undoubtedly, is a convenience much appreciated by importers in this country. Finally, Germany has an extensive Consular service in this country, maintained at great expense. It is thus seen that both the Government and the manufacturers of that country are fully alive to the importance of the South African market, and are making great efforts to foster trade relations therewith.

Electrical Work on the Rand.

A report on the trade of South Africa would not be complete without special reference being made to the effect which the conversion from steam to electric drive in the mines has had upon the trade of the country. The figures given under the head of "Electrical Goods" make this clear. These figures are :—

1907	£308,513
1908	478,359
1909	631,865
1910	1,428,888
1911	1,030,627
1912	917,186

As is generally known, the Victoria Falls and Transvaal Power Co., and the Rand Mines Power Supply Co., have erected central power stations on which so many of the gold mines now depend for their supply of electricity and compressed air. It should, therefore, be interesting to manufacturers to have particulars of the rapid strides made by these two power undertakings since they started. These particulars have been provided by the Chamber of Mines in the following terms :—

"In 1907 the Victoria Falls and Transvaal Power Co. started by taking over the two then existing companies—the Rand Central Electric Works, with a plant capacity of 3,200 KW., and the General Electric Power Co., which had a plant capacity of 2,500 KW., or a total of 5,700 KW. Toward the end of 1908 the new station of the Victoria Falls and Transvaal Power Co. at Brakpan was started up, and supplied 6,000 KW. produced by two 3,000-KW. turbines. In 1909-10 this was augmented by the Simmer Pan station, with six 3,000-KW. turbines, so that by the end of 1910 29,700-KW. turbines were being supplied, 24,000 KW. of which constituted new supply. During 1911 and 1912 the Rosherville power station, owned by the Rand Mines Power Supply Co., was completed, consisting of five 10,000-KW. turbines and six steam-driven turbo-air-compressors of a capacity of 3,500 KW. each. The station at the Robinson Central Deep, consisting of six electrically-driven turbo-air-compressors, of a capacity of 3,250 KW. each, was also completed, and the advance made at the Vereeniging station allowed of two further 10,000-KW. sets being brought into operation, so that the combined plants of the two power companies at the end of 1912 had a capacity represented by the following large figures :—94,000 KW., electric plant ; 40,500 KW., air-compressing plant.

"The following additional plant is on order and in course of erection :—

"For the Victoria Falls and the Transvaal Power Co., two 11,000-KW. turbines, to be erected at Simmer Pan.

"For the Rand Mines Power Supply Co., two 12,000-KW. turbines, to be erected at Vereeniging. One of the latter is almost ready to be placed in commission, while the other is expected to be ready in June.

"Finally, three 7,000-KW. steam-driven turbo-air-compressors will be erected at the Rosherville station, and it is interesting to state that these will be the largest air-compressors so far constructed. By the end of March next year, when the installation of all plant at present contemplated is anticipated to be completed, the combined capacity of all the power stations should be :—140,000-KW., electric plant ; 61,500-KW., air-compressing plant. These figures, it must be admitted, are enormous. Great credit is due to these power companies for their enterprise in initiating these works—calling for huge sums of money—to enable them successfully to cope with the large demand for power made by the mines and other industries on these fields."

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Simplex "Diamond" Suction Cleaner.

Messrs. Simplex Conduits, Ltd., of 116, Charing Cross Road, W.C., are introducing a new form of machine which, on account of its specially shaped nozzle, has been named the "Diamond," and is marketed at a very low price.

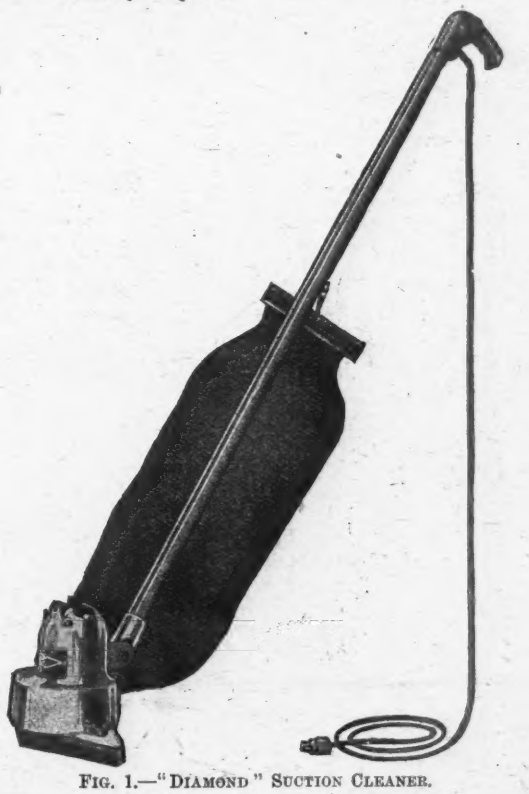


Fig. 1.—"Diamond" Suction Cleaner.

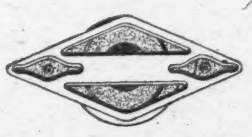


Fig. 2.—"Diamond" Nozzle.

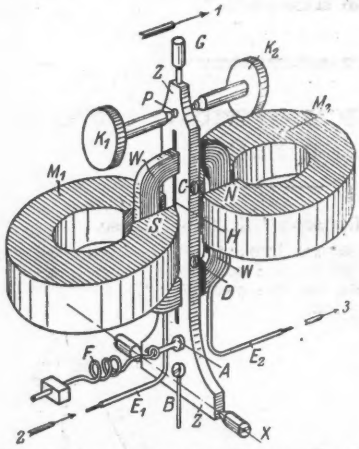
Fig. 3.—Nozzle for Wood Floors.

The general appearance of the machine is shown in fig. 1. The nozzle is of peculiar construction, as shown in fig. 2, and has been fully protected by patents ; the actual working area is larger than that usually allowed for, and its shape is of advantage, in that by means of the sharp corners it can penetrate into crannies otherwise inaccessible. The design has also been adopted from consideration

of the wear and tear upon the carpets, &c., which it may be desired to clean. When using the ordinary form of nozzle, a portion of the carpet, equivalent to the area of the nozzle, is sucked right up into it, giving a distinct dragged effect when the nozzle has passed over the surface of the carpet. This effect has been especially noticeable with high-power vacuum cleaners, and is said to tend towards a considerable diminution in their useful life.

The attachment for cleaning hard wood floors is shown in fig. 3. The slot through which the dirt is drawn precedes the felt, which is pressed on to the surface of the floor, in whatever direction the machine may be moved, whereas with other forms of nozzle the dirt is continually being pushed away from the slot and rubbed into the floor. The machine is only 8 lb. in weight. A turn switch in the handle allows the motor to be started or stopped at any desired moment, and the "pistol grip" handle enables the machine to be easily operated with one hand, a great convenience on occasion. A simple form of spring clip allows the bag to be detached in a moment, without fear of spilling the contents.

Various accessories are supplied with the "Diamond" suction-cleaner, and a very simple and effective device is adopted for the purpose of attaching them to the machine. The "Diamond Special" is a larger and more powerful machine, using a motor of ½ H.P., and designed for large establishments, hotel work and so forth.



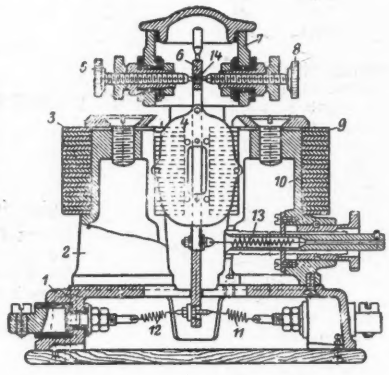


FIG. 4.—ARRANGEMENT OF RELAY. FIG. 5.—SECTIONAL ELEVATION OF ZELISKO RELAY.

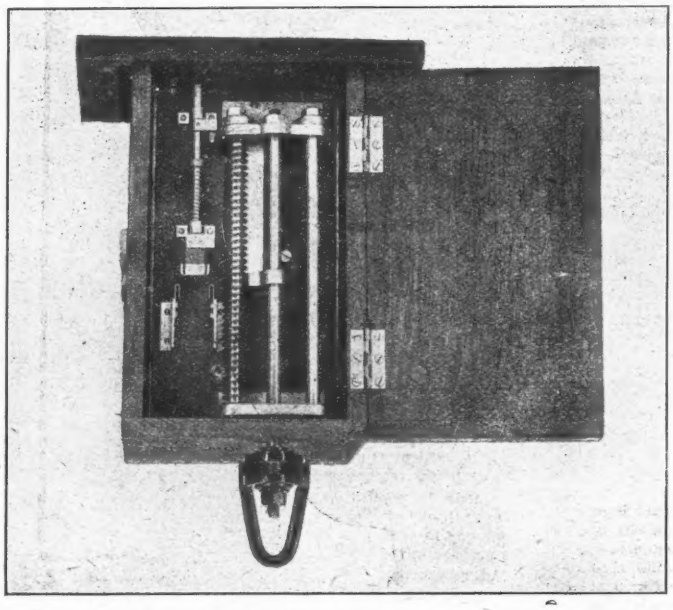
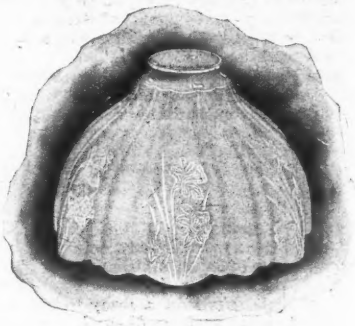
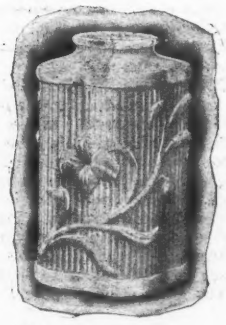
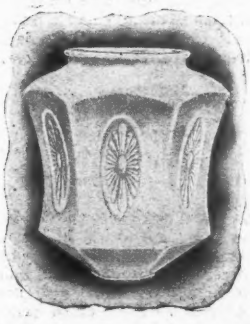


FIG. 6.—STAIRCASE LIGHTING SWITCH.







FIGS. 7-9.—NEW VELURIA GLASSWARE.

Staircase Lighting.

Writing with reference to the article on staircase lighting switches which appeared in our issue of August 22nd, MESSRS. ERNEST F. MOY, LTD., of Camden Town, N.W., inform us that they have recently supplied a number of switches for this purpose which have been in use for some months past.

The switch, shown in fig. 6, is arranged for fixing on the ceiling at the top of a "well" staircase, and is operated by means of a flexible wire cord hanging vertically in the well, a handle being fastened to the cord at each landing. A pull-down of about 6 in. closes the switch and compresses the spring seen in the illustration. The spring drives a train of wheels through a rack and pinion, the control being effected by means of a brake after the fashion of a gramophone spring-motor control. The switch will carry up to about 5 amperes, and is fitted with a quick-break action. The light remains on for one minute, and owing to the lost time between the pull-down movement and the switch, the circuit is not closed unless the operator gives a full traverse to the cord.

On a well staircase it is quite an easy matter to find the cord and actuate the switch again in the event of the light going out before the desired floor is reached. The apparatus is cheap, as is also the cost of installation.

New Veluria Glassware.

Some new Veluria designs have recently been placed on the market by the BRITISH THOMSON-HOUSTON CO., LTD., of Mazda House, Upper Thames Street, E.C., three of which are illustrated herewith. As is generally known, Veluria is a white translucent glass, with remarkable properties of diffusion and reflection, which ensure a high degree of comfort and efficiency in the resultant illumination. Veluria reflectors are also extremely beautiful in themselves, and have thus bridged the gap which formerly existed between the merely pretty art glass shade and the purely scientific reflector.

One of the new patterns of Veluria (Cat. No. S 5,227) has the same contour and reflective characteristics as the standard intensive type, with the addition of an etched floral design which considerably enhances its appearance without impairing its efficiency. This reflector is made in four sizes to take Mazda lamps ranging from 10 to 100 watts.

The other patterns (S 5,218 and S 5,219) have raised decorations of distinctly novel and attractive appearance, and, as they are intended solely for domestic purposes, are made in one size only, to take Mazda lamps of from 10 to 40 watts.

Zelisko Moving-Coil Relay.

An older form of this relay has been in use for several years past in the Austrian telegraph department. The latest model (see fig. 4, which shows the essential features of the instrument in perspective), is characterised by the perpendicular tongue Z pivoted on the spindle X. In the upper part of the aluminium tongue, platinum contacts P are let into the brass rivet 14 (fig. 5). The

flat moving coil W is wound in a plane perpendicular to the axis of rotation of the tongue Z, and is held by the screws C D. Two permanent ring magnets are arranged as shown, and the tongue is controlled by the spring F.

Referring to fig. 5, which illustrates the actual construction of the relay, a hollow magnalium bedplate 1 carries two vertical members connected by the box-shaped attachment 7. The bedplate carries three local and two line terminals as well as two bearing screws between which the relay tongue 6 is pivoted. The coil frame 4 moves in the narrow air gaps of the two permanent magnets, and flexible connections are carried from the moving coil to the line terminals. The relay tongue is connected to one local circuit terminal *via* 12, and the other two terminals are connected to the contact screws 5 and 8. The laminated permanent magnets are built up of stamped rings 3, 9, &c., screwed down on to cast-brass pillars, as shown. The air-gap of the field-magnet is 1·6 mm. greater than the thickness of the moving-coil, and the latter always moves parallel to the pole faces. It is an easy matter to remove the magnet pillars, thus completely exposing the relay tongue and moving-coil, &c. Naturally the electro-dynamic torque is in the same direction on both sides of the moving-coil. The chief advantages of the new, as compared with the older, type of relay lie in the easy accessibility of the local circuit contacts, and the impossibility of contact between the moving-coil and the field-magnet. The form of the magnet prevents the formation of deleterious stray fields, and permits cheap construction and the adjustment of the tension springs and the torque on the moving-coil are practically independent of the setting of the contact screws. The "latent period" of the relay is about 0·007 second, with a line current of 17 milliamperes, a spring tension corresponding to a current of 8·5 milliamperes, and a tongue stroke of 0·01 cm.—*E.T.Z.*

Mazda Half-Watt Lamp.

The accompanying illustration, fig. 10, shows one of the Mazda "Half-watt" lamps that were recently exhibited by the BRITISH THOMSON-HOUSTON CO., LTD., as reported in our last issue (pages 322 and 346). This lamp takes 10 amperes at 80 volts, and gives

FIG. 10.—MAZDA HALF-WATT TUNGSTEN LAMP OF 1,600 C.P.

1,600 C.P. at an efficiency of 0·5 watt per candle. The simplicity of the filament is the most striking feature of the lamp, as compared with the metal-filament lamps in ordinary use. These lamps are not yet on the market, but will be ready in three months or so.

"Beacon" Pipe or Conduit Clip.

MESSRS. SMITH & DAVIS, LTD., of Hampton Street, Birmingham, have recently placed on the market the new hinged patent pipe clip, shown in fig. 11. This is made of heavy gauge sheet metal to

FIG. 11.—THE "BEACON" CLIP.

suit external pipe or conduit diameters ranging from ⅜ in. to 1½ in. diameter, and it supports them about ¾ in. clear of the wall. The hinged clip is fastened with a small bolt and nut, which allows for small variations in diameter of the pipe or conduit.

The E.A.C. High-Torque Induction Meter.

A new single-phase meter has just been introduced by the ELECTRICAL APPARATUS CO., LTD., of Vauxhall Works, South Lambeth Road, S.W., in which special attention has been given to the production of a high torque, with a view to ensuring permanent accuracy. The minimum value regarded by the makers as likely to give satisfaction is 7 gm. cm., but they go further and guarantee a torque of 9 gm. cm. In view of the impossibility of completely eliminating friction from a meter, and the certainty that the friction initially present will increase as time goes on, it is obvious that the only sure way to minimise its deleterious effects on the accuracy of the meter is to swamp it, and this is the course adopted by the company, who claim that their meter has a torque

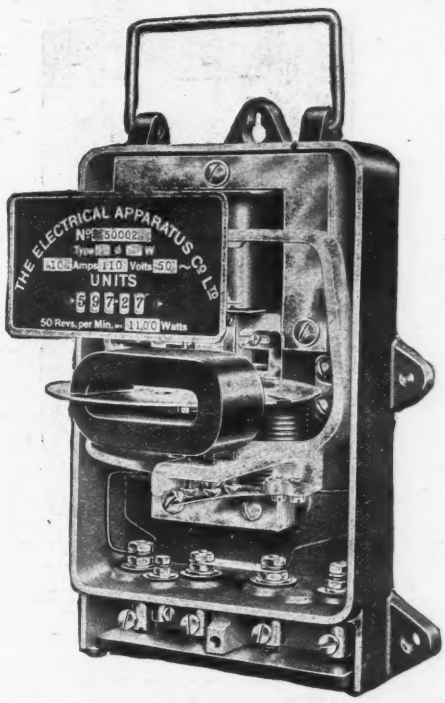


FIG. 12.—E.A.C. HIGH-TORQUE S.P. INDUCTION METER.

30 per cent. higher than that of any other on the market. The efficiency of the meter, however, has not been sacrificed to this end, for the total loss in the shunt system is 1·4 watts, and in the series system 1 watt only. Separate magnetic circuits are provided for the shunt and series systems, which render the instrument practically independent of changes of voltage, wave form and frequency; an excellent calibration curve is obtained, and the accuracy of the record is maintained over a

FIG. 13.—MECHANISM REMOVED FROM E.A.C. METER.

wide range of voltage, a meter designed for 110 volts giving results accurate within 2½ per cent. at any voltage between 170 and 50, without injury and without requiring recalibration. Temperature effects are negligible. By providing three holes in the disk, creeping on no-load is prevented, though the meter starts with less than ½ of 1 per cent. of full load, and compensation for friction on low loads is provided.

The meter is insulated mainly with mica, so that the insulation does not deteriorate in tropical climates, and is housed in an iron case which shields it from external magnetic fields.

The general arrangement of the meter is shown in fig. 12, and fig. 13 shows the moving parts, which are carried, together with the brake magnet, in a cast-iron frame, and can easily be removed for inspection and adjustment. The magnet is of high-grade tungsten steel, well aged and tested, and is mounted so that the poles can be moved inwards or outwards to adjust the speed of the rotor.

Fig. 14 shows the magnetic circuits, which are of English charcoal transformer iron laminations, and are not in any way interlaced with one another or threaded through the shunt coil, so that the

latter can readily be removed. The shunt coil is exceptionally well insulated, the silk-covered wire being wound together with a silk braid which encloses the wire, and the whole being vacuum-impregnated with a damp-proof insulating varnish. The low-load and inductive adjustments are shown in fig. 14; the latter consists of a small copper frame round the centre pole of the shunt system, which can be moved up or down to regulate the speed of the meter

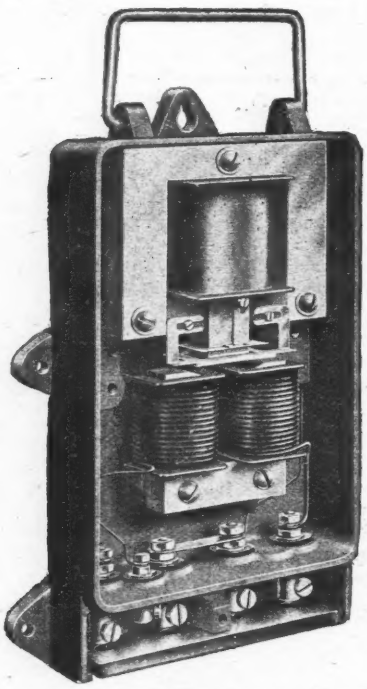


Fig. 14.—Magnetic Systems of E.A.C. Meter.

on inductive loads, while the former consists of a larger rectangle carried on a frame which can be moved to the right or left to vary the torque. Every effort has been made to improve the mechanical design of the meter, and all parts are standard and interchangeable.

BUSINESS NOTES.

Russia as a Trade Outlet.—On the outlet for electric material and machinery in Russia, the "Exposetur" of the Austro-Hungarian Commercial Museum at Warsaw writes:—The Russian electrotechnical industry stands at a very low level of development. Besides the wholesale firms of Siemens & Halske, Schuckert & Co., A.E.G., and Westinghouse, which either manufacture electrotechnical material or import them from their parent houses, very few undertakings exist in Russia concerned with the output of electrical wares, on account of which, to meet the rapidly rising demand, recourse must be had in overwhelming proportion to foreign works. Glow lamps are certainly made in Russia, but to so limited an extent as to be wholly inadequate to cover the enormous demand; so that for metal-filament lamps, which are coming more and more into use, Russia is thrown back almost wholly on to imports from abroad. These goods are mainly supplied from Germany and Austria, and only in inconsiderable quantities from England and France. This leading export article of the Bohemian electrotechnical industry totalled 25 per cent. of the aggregate exports to Russia, which is the best market for it. With intensive cultivation of the consumer, the export might, however, be greatly increased. Of glass goods the Bohemian industry exports considerable quantities, but the shipments of crystal ware might be greatly increased. Electric carbons are manufactured at Lüblin and Moscow, and cover the bulk of the Russian demand, so that the foreign article is only imported to a very restricted extent. Cinema carbons and transmission material are turned out by some well-equipped firms which are syndicated under the style of the St. Petersburg United Cable Works, Ltd., which allows of only a moderate foreign importation. Insulating tubes are made by a special factory at Warsaw, and another factory has its seat at St. Petersburg. Electrotechnical porcelain is made in Russian Poland by the Cmielow Co., whose output supplies the requirements. India-rubber and gutta-percha insulating materials are turned out by several monopoly concerns (the "Psowodnik," "Treugoldnik," "Kautschuk"). Installation accessories (switch and contact apparatus, brackets and fitments) are supplied from Germany, France and Sweden. Fans come from Germany and Italy. Dynamos, motors and transformers, and measuring and calculating instruments, have a great sale in Russia, and are principally supplied by Germany, Switzerland and Great Britain. The efforts of Bohemian manufacturers to extend their export relations with Russia are greatly facilitated by the fact that the wholesale trade is in the hands principally of solid Polish firms, who prefer Austrian goods. On the other hand, cash dealings with small consumers are beset with many difficulties. The Russian market is worth greater attention than has hitherto been bestowed on it, which attention will be crowned with success when the market circumstances are better understood and catered for. In particular, the sending of catalogues alone is useless, and the principle, cash on delivery, is neither in vogue nor practicable.—*Der Elektrotechniker.*

Lowering Gear for Metal-Filament Lamps.—The street lighting at Fulham is marked by a rather unusual feature, the metal-filament lamps being fitted with lowering gear. The London Electric Firm, of Croydon, have supplied about 200 brackets and sets of gear for this installation. The gear is of their well-known positive-acting, weight-relieving type, and the winches are of their self-sustaining type. The brackets are of the rectangular type, with pulleys and tubes fitted inside to prevent the rope from touching the electric cables, which are also inside.

Phœnix Mining Machinery.—On Saturday last a large body of mining electrical engineers, representing directly nearly all the collieries in Yorkshire and, indirectly, the Association of Mining Engineers of Great Britain, visited the works of the Phœnix Dynamo Co., Ltd, at Bradford, for the purpose of investigating the company's machinery and apparatus for employment in mines. The visitors were received by Mr. Pybus, managing director, Dr. Pohl, and others, and were shown all that the company has developed in the direction of decreasing the risks of the men in mines, and some designs for which a considerable element of novelty is claimed. One of the motors running, which was capable of developing 900 H.P., was employed for driving a large fan for ventilating a mine. Thirteen other machines similar in size, and used for this class of work, were seen in the works. Another machine inspected was a motor which embodied a device such that a violent explosion could take place inside the motor without the flame being communicated to the outside atmosphere. In the works of the Phœnix Co. there is a large explosion chamber, and very interesting experiments were carried out in the presence of the visitors in an endeavour to reproduce actual underground conditions. Replying to a vote of thanks, Mr. Pybus said that the commercial element was too powerful in buying plant, and the practical colliery engineer had far too little to say in matters often involving human lives.

Warner Non-Parallel Axle Trucks.—The "M. and G." Truck and Engineering Co., Ltd., have received the third repeat order from the Colombo Tramways for "M.G. Warner Trucks," making four consignments in all of Warner cars dispatched to Colombo. The company's agent, now in London from Colombo, states that the Warner cars require practically no attention and can always be relied upon. The wheel-base is 9 ft.; length over body, 18 ft. 8 in.; length overall, 28 ft.; gauge, 3 ft. 6 in.

Bankruptcy Proceedings.—A. E. Martin (trading as the Midland Electrical Supply Co.), Birmingham, electrical engineer.—Notice is given of release of trustees, June 19th, 1913.

A. E. E. Daniels (trading as Middleton & Co.), Canterbury, electricians.—Notice is given of release of trustees, July 2nd, 1913.

Private Arrangements.—The British Electromobile Co., Ltd., 5 and 6, Halkin Street, London, S.W.—In pursuance of the provisions of the Companies' (Consolidation) Act, a meeting of the creditors interested herein was held at the offices of Messrs. A. W. Barr & Co., 1, Queen Victoria Street, E.C. It was reported by the liquidator (Mr. R. B. Tyler) that the meeting was purely a formal one; the company had gone into voluntary liquidation, as it was desired to change the name of the concern to the Opel Motors, Ltd. The company was perfectly solvent, and those creditors who had not been paid would receive payment in full within a short time. The voluntary liquidation of the company is being continued with Mr. Tyler as liquidator.

M. Sims, 46, Leigh Road, and Milton Road, Southend-on-Sea, electrical engineer, &c.—The creditors interested herein were called together on Monday last, at the offices of Messrs. Osborn & Osborn, solicitors, Coleman Street, E.C. A statement of affairs was presented, which showed liabilities of £690. There were also partly secured creditors for £475, who held securities valued at £450. The assets were estimated to realise £362, less £27 for preference claims, leaving a deficiency of £355. The debtor had been in business for about 16 years. The present position was attributed to bad trade. The creditors decided that the estate should be realised under a deed of assignment, with Mr. Mortimer as trustee. A committee of creditors was also appointed.

Vitty & Hopper, Ltd., electrical, hydraulic and mechanical engineers, 96, High Street, Ramsgate.—A meeting of the creditors of the above was held on August 27th, at the offices of the liquidator, Mr. J. W. Scarlett, 36, High Street, Ramsgate. A statement was presented which showed liabilities of £852 15s., of which £538 9s. 9d. was due to trade creditors, and £146 16s. 4d. to a cash creditor, while the bank were also interested for £63 2s. 11d.

The assets were estimated to realise £890 6s. 10d., and as regarded the creditors a surplus was thus disclosed of £37 11s. 10s. The issued share capital of the company was £1,250, and as regarded the contributories there was a deficiency disclosed of £1,212 8s. 1d. The company, which was a private one, was registered in March, 1911, with a nominal capital of £1,500, to take over two businesses which had formerly been carried on respectively by Mr. Vitty and Mr. Hopper. The liquidator stated that he was in negotiation with parties who were likely to take over the business as a going concern. The creditors passed a resolution confirming the voluntary liquidation of the company, with Mr. Scarlett as liquidator, and a committee of the principal creditors was also elected.

Book Notices.—"Chronology of Aviation." By Hudson Maxim and W. J. Hammer. New York: From the Authors.

"Nouveau Guide Pratique de l'Usager d'Acetylène." Paris: Office Central de *l'Acetylène*. Price 1 fr. 50. 1913.

The September issue of the *Wireless World* contains an account of the part played by wireless telegraphy in the recent naval manœuvres, descriptions of Prof. Korn's process of transmitting photographs and drawings by wireless telegraphy, and the St. Kilda station, and an article on steam trawlers and their work. A good deal of space is allotted to articles of interest to amateurs and to the solution of other people's difficulties.

Trade Announcements.—Messrs. Brotherton Tubes and Conduits, Ltd., have now moved into larger premises situated at 4, Carr Street, Blackfriars, Manchester, where increased stocks will be available. This depôt will in future be under the management of Mr. T. A. Nunwick, who also represents The Wandsworth Electrical Manufacturing Co., Ltd., of Birmingham, and Messrs. Pritchetts & Gold, Ltd., of London, in Lancashire, Yorkshire and Cheshire.

Messrs. L. E Wilson & Co., electrical engineers and contractors, sole agents for the Thomson electric lamps, aero fire alarm, &c., who have been for some years located at 20, Cross Street, Manchester, give notice that owing to the extension of business they are removing to new premises at 10, Corporation Street, Manchester (Telephone, City 344; Telegrams, "Telephony," Manchester) on September 8th next.

Messrs. F. B. Nathan and F. S. Allen have opened an office and showroom at Queen Anne's Chambers, Westminster, S.W. They represent the Kartret Engineering Co., who manufacture switchgear, and the Wardle Engineering Co., Ltd., makers of lanterns and fittings for streets, shops and works.

Messrs. Henrion Carbons inform us that as their output to England has grown more important, they have decided to open a branch office in London, at 34, Victoria Street, S.W., under the management of Mr. R. Serena. The firm, as is well known, specialises in electric carbons for open, enclosed, and flame arc lamps, brushes for dynamos, &c., and battery plates.

Messrs. Pyne, Hughman & Co., electrical and general engineers and contractors, of Calcutta, have opened a London office at Bank Chambers, 329, High Holborn, W.C., and have appointed Mr. F. M. Short as their manager for Europe with headquarters at the above address. Prior to this appointment, Mr. Short was for 14 years in charge of the electrical department of Messrs. Balmer, Lawrie and Co., of Calcutta.

Messrs. Saville & Walton, electrical engineers and contractors, of London and Cardiff, are opening a new branch business at High Street, Cobham (Surrey), where a supply of electricity is now available.

Henry Strafford & Son, Harrogate, electrical engineers.—Notice is given in the *London Gazette* that the business carried on by Henry Strafford and Fred Strafford under the above style has been sold to Mr. Albert Lappin, by whom it will be carried on under the same style, as from August 25th.

The new London address of Messrs. Rhodes Motors, Ltd., is Sanctuary House, Tothill Street, Westminster, S.W.

Liquidation.—Stoltz Electrophone Co. (London), Ltd.—At meetings on July 28th and August 19th it was resolved that the company be wound up voluntarily, and that Mr. Elliott Thorpe, 45, Chancery Lane, W.C., be appointed liquidator. Notice is given in the *London Gazette* that a meeting of the creditors will be held at Cannon Street Hotel on September 8th, at 3 p.m.

Catalogues and Lists.—The Westinghouse Cooper Hewitt Co., Ltd., 80, York Road, London, N.—List No. 39 B, just issued, of silica lamps for power circuits; it describes and illustrates the type Z5 lamp, which is distinct from other types in that it operates in parallel on high voltage and can be used where a D.C. 500-volt supply is available. The power consumption is given as ·37 watt per C.P.

The Westinghouse Brake Co., Ltd., 82, York Road, King's Cross, N.—Brochure describing the Westinghouse steam-driven air-compressors, vacuum pumps, water pumps and boiler feed pumps, with details of sizes and outputs.

Landis & Gyr, Ltd., 28, Denman Street, London, S.E.—Descriptive pamphlets relating to watt-hour meters for single and polyphase circuits; these are fitted with a special footstep bearing, and are claimed to have a high torque in spite of very small energy losses.

The Phœnix Dynamo Manufacturing Co., Ltd., Thornbury Works, Bradford.—Bulletin No. 25, containing 13 pages of illustrative and descriptive matter relating to large alternating-current motors for driving colliery fans and compressors. Detailed views are given to illustrate the robust construction employed, and views are included of turbine-driven machines, electrically-driven fans, explosion-proof motors, &c.

LIGHTING and POWER NOTES.

Aberdeen.—Mr. Bell, the city electrical engineer, has outlined the scheme for lighting Aboyne, pointing out that it depends on the decision of Banchory, and will also affect the proposal to supply Ballater. The City Council would supply energy in bulk to the local authorities, who would carry out the distribution, &c.

Accrington.—Proposed Loan, &c.—The electric street lighting in Blackburn Road, Manchester Road, Peel Street, and Clayton-le-Moors is now completed, and similar work in Whaley Road is in progress.

The Electricity Committee was informed a few days ago that the gas plant continued to work satisfactorily, and that the sulphate of ammonia yield was giving steady returns. Some 17 tons had been sold, and there were about 12 tons in stock.

Application is to be made to the L.G.B. for sanction to borrow £3,050, £2,500 for the provision, extending over three years, of consumers' H.T. sub-station equipments, switchgear, transformers, and service cable; and £550 for the provision of water-cleaning plant and the necessary piping to deal with 6,000 gallons of river water per hour.

The L.G.B. has sanctioned the borrowing of £1,060 for extra-H.T. mains to be laid from Clayton-le-Moors sub-station to Rishton Paper Mill, to be repaid within 25 years, and of £940 for switchgear and transforming plant, to be repaid within 15 years.

In response to a request from Messrs. Lupton Bros., Ltd., the Electricity Committee has decided to couple both the works of the firm by one cable and aggregate the consumption of current.

Algeria.—La Société Les Exploitations Electriques has secured the concession for the supply of electricity for lighting and power purposes in the town of Assi-Bon-Nif. It is also in negotiation for a similar concession in the town of Mers-el-Kebir.

Argentina.—La Compania Italo-Argentina de Electricidad, which is establishing a large electricity supply station in Buenos Ayres, has placed a contract with Messrs. Franco Tosi & Co., for the supply of eight multitubular boilers, with superheaters and economisers, each of 500 sq. metres heating surface; a 7,500-H.P. steam turbine, and four 800-H.P. Diesel four-cycle engines.

The Mayor of Rosario has had an interview with the Mayor of Buenos Ayres, and has requested the services of an engineer to study the question of the public lighting in Rosario in connection with the tenders that have been received. Engineer Ernesto Newbery, the actual chief of the Public Lighting Department, has been appointed to act on behalf of the Rosario Municipality.—*Review of the River Plate.*

The Compania Anglo-Argentina de Electricidad continues to make steady progress, and it has recently acquired the electric light stations in San Juan, Resistencia, Bragada, Necochea and Trenque Lauquen. The company now possesses 17 electric light and power stations, two gas works, one electric tramway and one telephone system.

Australia.—The Sydney City Council, having arranged a special tariff for the supply of electric current to electrical contracting and supply houses for the purpose of demonstrating machines and appliances with a view to further enlarging the scope of electrical business, the Melbourne City Council has adopted a similar arrangement with local contractors. The rate proposed is 1½d. per unit for lighting, power and heat.—*Commonwealth Engineer.*

Bacup.—It is proposed by the T.C. to seek the sanction of the L.G.B. to the borrowing of a sum of £1,800 in connection with the electricity services of the Corporation.

Ballyconnell (Co. Cavan).—On September 10th, a L.G.B. inquiry will be held into the application of the Bawnboy R.D.C., in regard to the electric lighting of Ballyconnell.

Belfast.—The Corporation has confirmed the recommendation of the Committee to obtain a site on the Musgrave Channel from the Harbour Commissioners for the new power station.

Bingley.—L.G.B. Inquiry.—An inquiry by the L.G.B. was held on Thursday, last week, in respect of the application of the local U.D.C. to borrow £7,000 for an electricity sub-station with transforming machinery, distributing cables and mains. The evidence on behalf of the Council was taken by Major Stewart, R.E., and there was no opposition to the application.

Canada.—A hydro-electric plant is proposed at Big Eddy (B.C.) on the Columbia River, where it is said comparatively little work will be needed to impound sufficient water to develop 300,000 H.P.; 30,000 H.P. hydro-electric units are spoken of, and an estimated cost of 23 million dollars. The *Canadian Engineer* calls it "the world's largest power plant"—but then, of course, there are others.

The Vancouver (B.C.) city authorities are proposing to construct a municipal power plant, and efforts are to be made to secure a suitable water power site.

Continental Notes.—Norway.—The power station of the Hogstad undertaking at Stemdal, about 30 miles to the north-west of the town of Larvik, has recently been completed and run experimentally. The power is obtained from the Stemdal River, which contains a number of waterfalls which it is the intention of

the owners of the rights to harness in the course of time. The first step has now been taken in harnessing the Hogstad Waterfall, which comes from the Vannebu Lake, and has a height of 135 m. The work was decided on in 1910, and a start was made in 1911. One of the features of the undertaking was the running of a tunnel 2,300 m. long, through which the water is conducted to a distributing basin, from which it runs to the power station. In the latter are provisionally installed two units with a total capacity of 5,000 H.P., to which will be added a further reserve unit. This station has several novelties from a technical point of view. The water turbines run at 1,000 R.P.M.; the generators are coupled direct, and supply three-phase current at 6,000 volts, which is stepped up to 60,000 volts, the latter being the highest pressure that has ever been employed in Northern Europe. Energy is transmitted to the town of Larvik, the length of the cable being 34 miles. From Larvik a branch line runs to the town of Sandefjord, which is also to be supplied with light and power from this source.

GERMANY.—3,000-H.P. DIESEL ELECTRIC SETS.—An important extension is about to be carried out at the municipal central electricity station at Bremen, orders having just been placed for two 3,000-H.P. Diesel engines and alternators. The engines, which which will be supplied by Messrs. Sulzer Bros., of Winterthur, will be of the six-cylinder two-cycle vertical type, designed to work with tar oil. The generators will be supplied by the A.E.G.

RUSSIA.—It is reported from St. Petersburg that a French syndicate has made an offer to the Russian Government proposing to construct locks in the river Dnieper, provided that the former is granted a concession to utilise the waterfalls for the production of power. The expenditure on the works is estimated at £4,000,000.

FRANCE.—A Franco-Swiss syndicate proposes to establish hydro-electric works for the utilisation of the power of the Rhone on French territory at Chaney, which is less than a mile distant from the Swiss frontier. The municipal council of Geneva had projected a similar scheme, but has decided to abandon it on the promoters of the rival works granting certain privileges to the Council. The cost of the works is computed at £400,000.

A large electric generating station with a capacity of about 15,000 H.P. is to be established near Fourchambault (Nievre) with the object of supplying power for the cement and other works in the Beffes district.

SPAIN.—Representatives of a number of the commercial firms in the city recently met in Madrid in order to protest against the high rates at present charged for electricity supply in the Spanish capital. It was decided to send a letter of protest to the supply companies and to approach the municipal authorities with the view of inducing the latter to see that the electricity concerns fully comply with the terms of their concession.

SWITZERLAND.—There has just been installed at the Löntsch hydro-electric station, near Glauris, a 15,000-H.P. Pelton wheel, which is declared to be the largest of the kind erected in Europe. The equipment of this station already comprised six 6,500-H.P. Pelton wheels, totaling 39,000 H.P., and the latest addition raised the total to 54,000 H.P., making this station the largest in Switzerland.—*L'Industrie Electrique.*

Cirencester.—The U.D.C. has given the Cirencester Electric Supply Co., Ltd., permission to erect three routes of overhead transmission lines.

Dartford.—The chief electrical engineer (Mr. J. D. Pember) recently issued his report on the accounts of the electricity undertaking during the year ended March 31st last. These accounts show a loss of £1,272, such loss being attributed to the coal and Thames strikes, which occurred during the 12 months. As proof of this, the engineer states that he finds that there were 1,465 tons 13¼ cwt. of coal used during the period under review, which were supplied during the coal strike and the Thames strike, at an increased cost of £360, which equals about 4s. 11d. per ton over the contract prices for the year ended June, 1912. The deliveries under the new contracts actually started in September, 1912, the South Hetton being 3s. 6d., and the Rubbly Culm, 2s. 10d. per ton above the previous contracts. There were 2,281½ tons delivered at these higher contract rates, involving an additional expenditure of £359, or an average of 3s. 1½d. per ton more.

Of the two strikes the Thames strike was possibly the worse, as it necessitate obtaining rail-borne instead of sea-borne coal, and having to pay the difference in the two rates of freights. The total amount paid due to these increases was £718, and the whole of it fell on the electricity department, as no increase was charged against the sewage department for the coal supplied for the sewage pumps.

Darwen.—Amongst the recommendations of committees to be brought before the T.C. this week is one to the effect that consumers of electricity for power purposes, having 100 H.P. and upwards installed and in use, be allowed electricity for lighting purposes at 1d. per unit net up to 5 per cent. of the monthly consumption for power purposes; any electricity taken in excess of the above 5 per cent. to be charged for at the ordinary rate of 4½d. per unit. The decision was arrived at in connection with the supply to St. Paul's Mill.

Doncaster.—The Corporation accounts for the year ending March 31st last, which have just been issued, bear striking testimony to the increase in the popularity of electricity in the borough. New customers are arriving every week, and the use of the current in business premises is becoming much more common. The electricity department has converted a deficit of £1 299 into a profit of £1,114.

Dundalk.—At the bi-monthly meeting of the Urban Council, Mr. P. A. Spalding, electrical engineer, reported that as regarded the street lighting, a number of extra 75-C.P. lamps were necessary in order to improve the lighting in certain main thoroughfares. The entire annual cost per lamp to cover the supply of current and maintenance would be £4 10s. The total number of services installed was over 280. The wiring of the artisans' houses in the town was well in hand.

Forres.—Mr. Purvis, of Edinburgh, has been asked to prepare a report on electricity supply in the burgh.

Galashiels.—The recently-formed company—the Galashiels and District Electric Supply Co., Ltd.—is applying for a prov. order, and intends as early as possible to build and equip a station. The Galashiels manufacturers are supporting the scheme, a municipal venture not having been carried out. In several of the mills the present engines are out of date, and failing electric power, new engines will have to be installed. The company has its head office at 23, Rutland Street, Edinburgh. The capital is £30,000, and leading manufacturers are among the subscribers.

Great Harwood.—In the course of a report on U.D.C. matters presented at the meeting of the Trades and Labour Council last week, Councillor J. Parker said that whilst the Council was in committee, the electricity question had been discussed, following a report of an interview with the Accrington authorities. There were two suggestions before the Council. One was to put down its own electrical plant and generate its own current, and the other was to obtain a supply from Accrington for a term of years. There had been much difference of opinion as to which course was the better, and nothing definite had yet been done. No doubt negotiations would continue for some time to come.

Haslingden.—Gratifying progress in regard to the consumption of electricity was reported at the T.C. meeting on August 27th. Councillor Waddington said they were justified in asking for authority to go fully into the question of a supply to Helmshore district. They had got a definite promise from the Park Mill, while Messrs. Whittaker Bros. and others proposed to take a supply. The supply on which they could already count was equal to more than a quarter of a million units per annum, which was more than was consumed in the borough of Haslingden at present. The Council gave authority to the committee to obtain specifications and estimates for the laying of the necessary cable.

Hebden Bridge.—LOAN SANCTION.—Having received the sanction of the L.G.B. to the borrowing of money for proposed extensions at the electricity works, the U.D.C. has decided to negotiate a loan for £3,250 on that account.

Hinckley.—HOSPITAL LIGHTING.—With reference to the lighting of the new hospital, mentioned in the last issue of the ELECTRICAL REVIEW, the Leicestershire and Warwickshire Electric Power Co. has informed the U.D.C. that it cannot give a guarantee for 20 years, but would give a guarantee for five years, taking the risk of any increase in the price of current. It would also give a guarantee for 10 years, providing the cost of coal did not go up; if there was any increase in the price of fuel, current would be advanced in price by $\frac{1}{10}$d. per unit on every increase of 2s. 6d. per ton. The present price of current, it was added, was 3d. per unit for lighting, and 1d. for heating. The architect has strongly recommended the installation of electric light as being more suitable than gas for a hospital, and the Council has further deferred its decision.

Holmfirth.—The U.D.C. has adopted new specifications in connection with the generating plant, &c., for the electric lighting scheme, and has called for fresh tenders from the three firms who submitted quotations. The Council has applied for permission to utilise a portion of the market site ground for the erection of the generating station.

Hungerford.—The R.D.C. has granted Messrs. J. and F. May, of London, contractors to Mr. H. E. Phillips, permission to use overhead wires for electric lighting purposes in the parish of Kintbury.

Kendal.—MARKET LIGHTING.—The T.C. has received tenders from the gas and electricity departments for lighting a portion of the fish market, and has accepted the quotation of the electricity department, amounting to £34 10s., for erecting a bracket lamp, fitted with three 200 C.P. lamps, and supplying same with current. The gas company's offer was for the erection of two 300-C.P. lamps at a cost of £31 12s. 4d. The B. of T. has approved the Council's proposal to erect overhead cables, and the work of putting these up is to be carried out at once.

Knottingley.—The U.D.C., on August 28th, confirmed a recommendation by the Electricity Committee to appoint Mr. J. W. Speight, of St. Anne's-on-Sea, as engineer to prepare a scheme of E.L. for the purposes of the prov. order which is being applied for, subject to his terms being satisfactory.

Leeds. — ROUNDHAY CO. ABSORBED.— Arrangements have been come to between the Roundhay and District Electric Lighting Co., Ltd., and the Corporation, whereby the former undertaking is to be transferred to the municipal authorities as from July 1st, 1914. The amount of the existing share capital is £12,390, and this, together with interest at the rate of £3 2s. 4d. per cent. on the ordinary share capital from the date on which the same was raised, and the sum of £500 for all the costs of the company incidental to the winding up and transfer of the undertaking to the Corporation, is to be paid on that date by the Corporation.

London.—Shoreditch. — The L.G.B. has sanctioned the proposal of the Guardians to enter into a contract with the Hackney B.C. for the installation of electric light at the Branch School, without in the first instance advertising for sealed tenders. The cost is estimated at £65.

Islington.—Workhouse Lighting.—At the last meeting of the Guardians, the Committee reported having had before it the subject of lighting the Workhouses, &c., by electricity. The Committee is to visit the Kensington, Hammersmith and Hampstead Workhouses, an institution at Barnes, and the Blind School, Leatherhead, Surrey, to view the E.L. installations there.

Mexico.—The contemplated harbour construction works at Tampico, to serve the petroleum oil fields, comprise, among other things, the erection of an electric generating station for the supply of lighting and power, the installation of electrically-worked loading appliances, and the construction of a railway, &c., across the Isthmus to the Pacific Ocean. A concession for the latter has been granted by President Huerta to an English syndicate which is also interested in the other schemes.

Navan.—At the recent meeting of the Urban Council a report was read from the Lighting Committee, recommending that application be made for a loan of £7,000 for the carrying out of the electric lighting scheme.

Newport (Mon.).—L.G.B. Inquiry.—An inquiry was held on August 27th, by Mr. T. C. Ekin, relative to the application of the T.C. for a loan of £10,600 for electricity purposes and the provision of a new turbine and other plant. There was no opposition.

Portishead.—Electric Supply Started.—The inauguration of the electric supply by the Clevedon, Portishead and District Supply Co. recently took place. The company has powers to supply the whole district between Portishead, Bristol and Clevedon, a triangular area of about 40 sq. miles, but is temporarily supplying Portishead alone. Formed with a nominal capital of £50,000, sufficient capital was raised last year to make a start with the work. The present plant consists of two Petter-Diesel engines of 100 H.P., which is ample for requirements in Portishead, but the existing engine room is large enough to permit two more engines of 200 H.P. being added. The streets will be lighted altogether with about 175 lamps each of 50 C.P. The engineers to the concern are Messrs. Christy Bros. & Co., and Mr. H. McLeod is resident engineer. It is expected before the end of next year to complete the supply over the whole of the area, at least so far as the principal villages are concerned, namely, Partbury, Pill, Abbott's Leigh, Leigh Woods, Long Ashton, Flax Bourton, Nailsea, Clevedon, Walton-in-Gordano, and Weston-in-Gordano.

Rothesay.—Proposed E.L. Plant.—The report of Mr. James Robertson, of Greenock, on the proposed destructor and electricity plant has been issued. The cost of the scheme is put at £13,000, and an estimated profit of £242 is shown for the third year of working.

Salford.—Subject to satisfactory terms being arranged, the city electrical engineer of Liverpool is to be appointed to report upon a proposal to modernise the generating plant of the Frederick Road electricity station. A special Sub-Committee has been appointed with reference to a proposal to supply three-phase current in the Ordsall district.

Trowbridge.—The question of allowing the local Electric Light Co. to use overhead wires in a portion of the town for the transmission of current was again discussed by the U.D.C. on August 25th. Mr. Edwards, representing the company, attended and explained that in the opinion of the B. of T. inspector there was no danger to the public from overhead wires up to a voltage of 460, and the voltage used in Trowbridge was only 230. He also explained that the existing cables laid from the power station were too small to carry the current necessary for the proposed extensions. The Council decided that no overhead wires should be allowed in Mortimer Street, Castle Street, and Newtown, the route desired by the company, and asked the latter to submit an amended route for overhead wires.

Tyldesley.—Street Lighting, &c.—It is reported that arrangements have been made for the lighting of the main streets with metallic-filament lamps, and also that a fairly large number of shopkeepers have decided to substitute electricity for gas in the immediate future.

Windsor.—Street Lighting Tests.—As the contract for street lighting terminates early next year, arrangements have been made whereby the respective values of electric and gas lamps shall be tested during the present month. The Electric Light Co. is to exhibit metal-filament and arc lamps, while the Gas Co. will erect special standard lamps, each being allotted certain places in the borough for that purpose. In this way the public will be able to estimate the value of each form of lighting.

York.—The City Council has decided to make application for a provisional order authorising the Council to supply the adjoining areas of Great Ouseburn, Bishopthorpe, Escrick, Tadcaster, Flaxton and Easingwold.

TRAMWAY and RAILWAY NOTES.

Ashton.—The threatened tramwaymen's strike at Ashton has been averted for the time being, the men having decided to postpone their notices and to take a ballot on the question as to whether or not the offer of the employers shall be accepted.

Australia.—A company under the name of the Townsville (Q.) Electric Tramway Co., Ltd., is being formed with a nominal capital of £60,000. The object of the company is to construct electric tramways in Townsville and suburbs.

The takings derived from the St. Kilda-Brighton electric tramways, managed by the Victorian Railway Department, for the financial year ended June 30th, amounted to £16,782, against £15,013 for the year 1911-12, and £12,852 for 1910-11.

The Midland Junction (W.A.) Council has recommended to the Government that, when providing for extensions and additions to the electric tramway system, the advisability of constructing a tramway to connect up Midland Junction with Bellvue, Greenmount and Swan View district be considered.

Continental Notes.—Austria.—The Ministry of Railways has granted concessions for a year for the preliminary studies in respect of a normal gauge electric railway from Pram-Haag, on the Austrian State Railways, to Station Haag, on the Lambach-Haag local line, Upper Austria; for a normal gauge electric line from Station Wels, on the Austrian State Railways, to Kleinmünchen, with a branch to a point near Linz, Upper Austria; and for a narrow gauge electric line from Abbazia, *via* Veprinaz, to the shelter house at the summit of Monte Maggiore (Küstenland).—*Der Elektrotechniker.*

Spain.—The last section of the electric railway between San Sebastian and the French frontier has now been completed and put into operation. The new line, which is about 12½ miles long, has been very costly, owing to the large number of bridges and tunnels that have had to be constructed; one of the tunnels is about 3¼ miles long, while one of the bridges has a length of over 80 yards. The necessary current for the line is supplied from a large power station on the borders of the provinces of Navarra and Guepuzcoa, where the water-power of the Puerte Maria Falls is being utilised. There is some talk of extending the line at a later date to Biarritz, France, so as to give a direct connection between this well-known resort and San Sebastian.

Italy.—A scheme for the electrification of the railway between Genoa, Ovada and Asti is at present under consideration.

Russia.—A company is in course of formation in St. Petersburg, its object being to construct and work an electric railway between Moscow and Vosreserak, a distance of about 35 miles.

France.—La Compagnie des Tramways de Paris et du Departement de la Seine is at present establishing a new sub-station, which is to supply power for two systems of electric tramways—overhead trolley and conduit. To this end the switchboards will be fitted with two sets of continuous-current bus-bars. The plant for the station, which is being supplied by the French B.T.H. Co., will comprise four sets of 750-KW. transformers. Each group will consist of a three-phase transformer receiving current at 10,250 volts, and 25 cycles. A series of six-phase rotary converters are also being installed; these will be provided with compound exciters, the ends of the shafts of which will be fitted with centrifugally-controlled safety devices.

Germany.—Work has been commenced on the electrification of about 140 miles of the State railway system in Silesia. The current necessary will be supplied from a privately-owned power station, which is being established at Mittelsteine, near Glatz, and which will have at first a capacity of 16,000 KW. The A.E.G. has secured the contract for the supply of two sets of 4,000-KW. steam turbines and single-phase alternators for 3,150 volts, 16⅔ cycles, and two 5,000-KW. transformers for stepping up the current to 80,000 volts. From the main power station the current will be transmitted at the last-named voltage to four sub-stations on the line of the railways, where it will be stepped down to 15,000 volts.

Lötschberg Difficulties. — The *Railway Gazette* correspondent, writing as regards the initial troubles on this line since its electrification, mentions that the collecting bows have had to be altered in shape owing to their sometimes losing contact with the overhead wire, apparently due to settlements in the tunnel arch.

Another trouble is said to have been due to the 15,000-volt trolley-line pressure being exceeded—this, again, resulting from atmospheric conditions and rapid changes in them. To remedy this excess pressure variation, water-jet pressure dischargers have been established at various points, in addition to the previous precautions taken.

Dartford.—The District Council has received a letter from Balfour, Beatty & Co., Ltd., stating that as their lease of the Dartford Light Railways expires in less than eight years, they will not be able to finance the construction of the connecting line between Horns Cross and the termination of the Gravesend tramways at Swanscome, unless such line is to be taken over by the Council at the same time as the lease of the light railways falls in, and asking if the Council will agree to take over the connecting line. The consideration of the matter has been deferred.

Darwen.—Dinner-hour Tickets.—It has been decided to issue a penny return dinner-hour ticket on all sections to or from the Circus between the hours of 12 and 1 on the outward journey, the return portion of the ticket to be available up to 2 o'clock. This will come into operation on October 1st, and will be given a three months' trial.

Doncaster.—From the Corporation accounts for the year ending March 31st last, just issued, it appears that the receipts of the tramways have grown from £17,302 to £20,346, another evidence of the growth of the outlying districts. A deficit of £53 has been converted into a profit of £1,290 though the expenditure is £19,000 against £17,855.

Dublin.—The tramway strike which occurred last week has, during the interval, degenerated into general rioting, in which idle members of the Transport Union and their sympathisers have played the principal part. According to reports some 600 persons have been injured and two killed during the week.

Dundee.—At a meeting of the Corporation Tramway Committee it was agreed to recommend to the T.C. that the Blackness line be extended from the present terminus along Blackness Road to Glamis Road, at a cost of about £500. A member asked whether there was any prospect of a permanent tramway being placed in Clepington Road in the immediate future instead of the railless system, but the manager said it would be a long time before they would be justified, from a commercial point of view, in putting down a permanent tramway line there. They were not earning half as much as the interest and sinking fund.

Halifax.—The T.C. has been recommended to double the existing tramway in Huddersfield Road, from the Punch Bowl to the Calder and Hebble, at an estimated cost of £1,140.

Huddersfield.—New Tramway.—The Corporation, the Elland Township Lands Trustees and the Elland and Greetland D.C.'s have now completed their arrangements for the extension of the Huddersfield tramways from Birchencliffe to West Vale, thus providing a through system from Halifax to Huddersfield. The Huddersfield Corporation has undertaken to have the tramway running before the end of the year. Considerable excavation work will be required at Long Wall—a rugged piece of ground—and it is proposed that when this is completed part of the ground shall be planted with trees, and the other laid out as bowling greens for Elland and Greetland.

Hunslet.—Information has been received by the Rural District Council that the Yorks. West Riding Electric Tramways Co. is seeking to abandon a portion of its agreement with the Council for the construction of a tramway from Rothwell to Oulton.

Leeds.—The Tramway and Electricity Committee has arranged to purchase land at Guiseley for the erection of a depôt and sub-station. Sanction has been received by the Corporation for the borrowing of £29,000 for a new tramway depôt in Sovereign Street.

London.—It was stated officially last week that the Metropolitan Railway had acquired the Great Northern and City tube as a going concern, and would take over the working of the line as from September 1st.

Future developments in connection with this line will be watched with interest, in view of the proposed connection with the Metropolitan Railway at Moorgate Street, and with the Great Northern Railway at Finsbury Park.

Newcastle-on-Tyne.—Annual Report.—The report of the general manager states that the past year established a further record in every way for the undertaking; the continuance of industrial prosperity in the locality was primarily the cause of the increase. The passengers carried showed an increase of 3 millons on the preceding year, and in every department there was an increase. The gross receipts increased from £223,565 to £235,321; traffic expenses from £60,663 to £64,493; general expenses from £17,730 to £18,674; general repairs and maintenance £27,122 (an exception), fell to £25,943; and power expenses increased from £13,004 to £15,508. The sum of £3,304 had been charged to revenue for the purchase of motor-'buses for the Westerhope route. A balance of £21,189 had been carried to the reserve and renewals fund, which then amounted to £119,407. The reserve and renewals fund would be heavily drawn upon during the current year, as it was necessary to renew considerable lengths of track and several junctions; additional plant had also to be provided at the power station to meet the heavy demands for power. The undertaking had reached an age when renewals must be encountered annually, and while there was no cause for uneasiness as to whether the undertaking could meet the expenses, so long as a firm policy was pursued in resisting all attempts to deplete the net annual revenue by saddling it with still heavier charges than it now carried, he pointed out that if such a policy was not pursued, the undertaking might eventually have to be supported out of the rates. In some statistical information it was stated that the passengers carried per car-mile were 10·92; traffic revenue per car-mile, 11·81d.; average fare per passenger, 1·082d.; cost per passenger, 0·593d.; power costs per car-mile, 0·779d.; traffic costs per car-mile, 3·238d.; repairs and maintenance, 1·302d.; total operating costs per car-mile (including public arc lighting), 6·477d.

Oldham.—A deputation has waited on the Tramways Committee to urge that instead of the motor-'bus service to Moorside, the tramway track should be extended at Grain's Bar so that a tramways service would be available. Mr. Dugdale reported to the Committee last week that at present the motor-'bus was the cheapest way of dealing with the traffic at this point. After a long discussion the Committee decided that the manager should get all the information necessary for a full discussion of the matter at a future meeting.

A Scotch Mountain Railway.—A scheme is proposed for the construction of a railway, about 4¾ miles in length, to the summit of Ben Nevis. The estimated cost of the work is £30,000.

South Lancashire.—The B. of T. has now given consent for the running of cars on the new track from Farnworth to Walkden, and a regular service was opened last week. A representative of the London and North-Western Railway Co. had objected to the running of the cars, on the ground that two bridges over the railway lines were not strong enough for the traffic. The cars are allowed to cross one of the bridges, but they cannot cross the other until it has been strengthened; this work is only a matter of a few days.

South Shields.—Proposed Tramway Extension.—At a meeting of the Harton P.C. on August 27th, it was unanimously decided to inform the T.C. that the Parish Council saw no objection to the proposed extension of the Shields tramways to Harton, and also to suggest to the Corporation the advisability of a further extension beyond the village, with a view of connecting the Shields system with that of Sunderland.

Tasmania.—The Launceston Tramways Committee has recommended that duplicate tram lines be laid down on the following routes:—Newstead—From Princes Theatre to the loop in Erina Street; estimated cost, £2.800. Mowbray—From loop in George Street to the loop at the Albert Hall; estimated cost, £875.

U.S.A. — 2,400-Volt D.C. Railway. — The Butte, Anaconda and Pacific Railway, which is the first 2,400-volt D.C. railway electrification in the States has recently been completed. The Butte-Anaconda section which has been equipped, comprises 30 miles of main line single track with sidings, yards, &c., bringing up the total to 90 miles. The haulage of copper ore, lumber, &c., amounts to 5,000,000 tons a year; trains weighing 3,400 tons made up to 50 loaded ore cars will be handled by two locomotives while single locos will be employed for shunting. The first equipment consists of 15 freight and two passenger 80-ton locomotives; pairs of freight locomotives will haul trains at from 15 to 21 miles an hour, while the passenger locos are geared for a maximum speed of 45 miles an hour. The locos are of the articulated double-truck type with all the weight on the drivers; each axle has a motor of the twin-geared type, fitted with commutating poles and wound for 1,200 volts, but insulated for 2,400 volts. The continuous rating of each motor is 190 amp. at 1,200 volts with forced ventilation, and 225 amp. at 1,200 volts for one hour. With a double locomotive unit this is equal to a continuous output of 2,100 H.P. Pantograph collectors are fitted and multiple unit control to operate four motors in series and series-parallel.

Wigan.—The statement of the tramway revenues for the past four months shows that the income exceeded the expenditure by £1,613. In the same period last year the expenditure exceeded the income by £1,255.

Wombwell.—Tramway Scheme.—The U.D.C. has considered the detailed estimate by Mr. Sellon (the consulting engineer for the joint authorities) of the cost of construction, capital cost, &c., of the proposed joint tramway service, by which the townships of Bolton-on-Dearne, Thurnscoe, Wath, Wombwell, and Darfield will be linked up. The Council decided to approve of the scheme so far as Wombwell was concerned.

York. — New Tramways. — Extensions involving an expenditure of £20,220 are under consideration by the Electricity and Tramways Committee, which has decided to recommend the Council to approve of the following suggestions:—Laying a new track from a junction with the existing system at Nessgate along Coppergate, Piccadilly, Walmgate, Lawrence Street and Hull Road to the Bee's Wing Hotel, the distance of the route being 1½ mile, and the estimated cost, including equipment and cars, £20,220; the extension from the present terminus at Acomb to the centre of Acomb village and from the Haxby Road terminus to White Cross Hill; to link up Heworth with York by applying for powers to run railless cars, and to obtain similar powers to run railless cars from Nessgate to Haxby Road, *viâ* Huntington Road.

CONTRACTS OPEN and CLOSED.

OPEN.

Austria.—September 29th. The Königliche Lagernhausern authorities in Trieste are inviting tenders for the supply of a large floating electrically-operated crane, complete with Diesel engine generating plant.

Basingstoke.—September 17th. Corporation. (Section *a*) Diesel generators, balancer set and booster set; (*b*) storage batteries; (*c*) switchboard and instruments; (*d*) cables and cable laying; (*e*) overhead travelling crane. See "Official Notices" August 22nd.

Brighton.—September 9th. Electrical fittings, for the B. of G. Mr. H. Burfield, Clerk, Prince's Street.

(*Continued on page* 384.)

ELECTRIFICATION OF THE SALT UNION WORKS.

In a manufacturing process in which the coal cost is one of the heaviest items of the production charges, it is only natural that every step will be taken to minimise the fuel consumption. The present article demonstrates how the electrification of the Salt Union Works has assisted to this desirable end in the manufacture of salt.

The coal is utilised primarily for the evaporation of brine, but a considerable portion is also accounted for by the requirements of pumping and other machinery about the works.

At the Winsford Works, which extend for some two miles along either bank of the River Weaver, there is, in addition to the usual open evaporating pans, a triple-effect vacuum evaporator which was formerly supplied with steam through reducing valves from six Lancashire boilers operating at 60-lb. pressure. This inefficient arrangement has now been done away with by raising the boiler pressure and utilising steam engines to reduce the pressure to that necessary for the vacuum evaporator, the power developed by these engines being used to generate electricity for distribution all over the works.

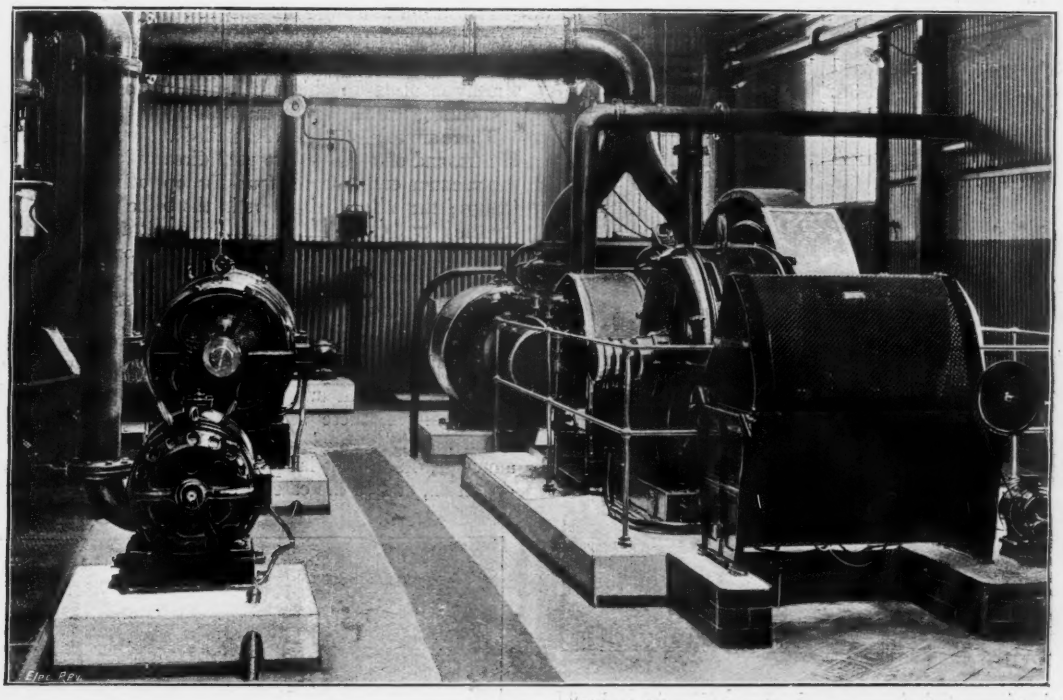
Mr. H. L. Riseley, of Newcastle-on-Tyne, was appointed consulting engineer to collaborate with Mr. G. W. Malcolm, chief engineer to the Salt Union, in the execution of this scheme. A specification was prepared and tenders obtained, and the order for the complete work including the provision of the generating sets, extensive overhead transmission lines, and motors with their necessary control gear, &c., and also the coupling up of these to the various drives, was finally placed with the British Westinghouse Electric Co., Ltd., at a cost of about £15,000.

A separate contract was placed with the Stirling Boiler Co., for three water-tube boilers to operate at 200 lb. pressure; the steam from these boilers is passed through either one or both of two 375-kw. Browett-Westinghouse generating sets. The alternators supply three-phase, 50-period, 600-volt current, which is distributed throughout the works by means of overhead lines, which were erected by the British Insulated and Helsby Cables, Ltd., as sub-contractors to the Westinghouse Co.

Through the courtesy of the latter firm, we are enabled to illustrate the power station and various other plant about the works. In all, about 50 motors have been installed at the Winsford Works, 10 of these being in connection with brine pumps previously driven by small isolated steam engines, which latter, with their boilers and attendants, have been abolished with vast economy.

The question of how best to drive the brine pumps required considerable attention before their electrification was undertaken, since they run at speeds between 7 and 14 r.p.m., and a reduction in speed is therefore necessary between them and the driving motors. It was ultimately decided to leave the spur wheel and pinion, which had previously connected the steam engines and pumps, *in situ*, and to couple 720-r.p.m. motors to the pinions through double-reduction helical gears, made by the Power Plant Co., which arrangement has proved eminently satisfactory.

Before operative results were available from the electrification of the Winsford Works, it was decided by the directors of the Salt Union that a larger triple-effect vacuum evaporator, together with electrical generating plant, should be installed at the extensive works at Weston Point, Runcorn. These works are away from the brine fields, but the requisite brine is pumped through about 10 miles of 15-in. diameter piping from Northwich, where it is raised by means of two Westinghouse-Rateau turbine pumps, each capable of dealing with 35,000 gallons of brine (sp. gr. 1·2) per hour.



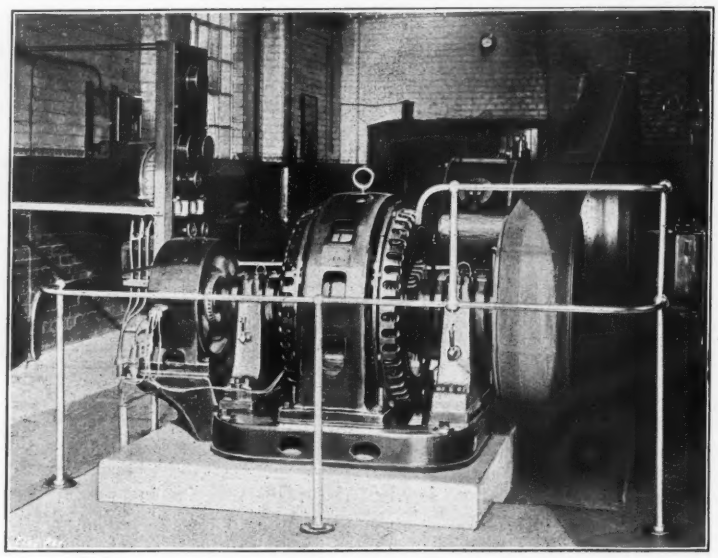
Westinghouse Motors in Pump Room of Vacuum Evaporator Plant, Weston Point Works.

The electrical power plant at Weston Point forms part of an entirely new works.

The boiler house, as at Winsford, contains Stirling boilers operating at 200-lb. pressure. Part of the steam raised was at first passed through either or both of two 725-kw. Browett-Westinghouse generating sets, and from the exhaust of the engines through a Baker oil separator to the vacuum evaporator. These engines each drive one 375-kw. three-phase 50-period 440-volt alternator and one 350-kw. 240-volt d.c. machine in tandem, the former for supplying current for power throughout the works, and the latter for electrolytic purposes. Since these sets were installed, the whole scheme has grown so rapidly that they now only form part of a far larger project.

From the beginning it was realised that the amount of electrical energy available from the steam required for the

vacuum evaporator would be far in excess of the requirements of the works, and, therefore, steps were taken to obtain provisional orders for the urban and rural areas of Runcorn and the town of Widnes. These being obtained, a subsidiary company, known as the Mersey Power Co., was formed to deal with this part of the undertaking, and a further order was placed with the British Westinghouse Co. for two 1,500-KW. reducing turbines, the alternators being in this case designed for generating three-phase current at 50 periods and 6,600 volts. Static transformers with the requisite switchgear are provided to form a connecting link between these alternators and those coupled to the reciprocating engines mentioned above.



70-KW. Westinghouse Gas-Engine-Driven Alternator and Switchboard, for Supply to Brine Pump, Marston Pumping Station.

An accompanying view (p. 382) shows the appearance of the power station at present with the turbine-driven sets in the foreground, and the engine sets behind. A third turbine, similar to the two now installed, is in course of manufacture, and will be erected and put into operation in the near future.

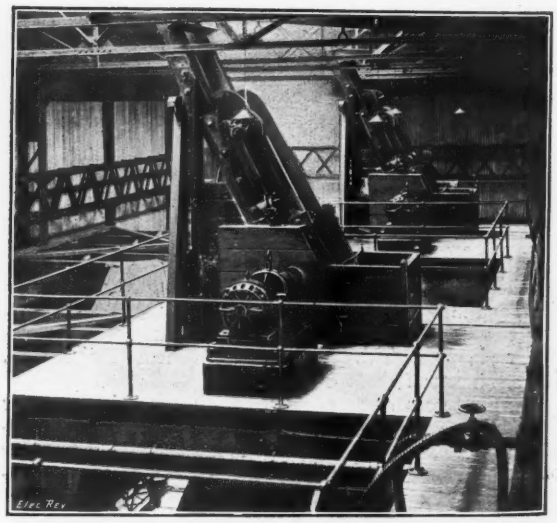
82-H.P. A.C. and 60-H.P. D.C. Motor-driven Pumps at Marston Underground Pumping Station.

A brief description of the reducing and governing valve gear will doubtless be of interest. A governor valve operated through an oil relay, in the usual way, controls the admission of steam to the high-pressure section of the turbine. This valve governs for speed alone, and is entirely independent of the reducing valve gear. The high and low-pressure stages of the turbine are divided by a solid diaphragm, the passage between the two parts being controlled by a balanced valve. This valve is opened and closed by an oil relay whose pilot piston is moved according to the position of a steam piston, one side of which is connected to the vacuum plant main. Suppose the vacuum plant to be taking all the exhaust steam, then the low-pressure section of the turbine is entirely out of commission, but if the supply of exhaust steam exceeds the demands of the vacuum plant, the pressure in the vacuum plant main arises, and moves the steam piston which shifts the relay pilot valve so that the oil relay opens the valve connecting the high and low-pressure casings. Steam then passes through to the low-pressure part of the turbine, and thence to the condenser. It will be seen that part or all of the steam may pass to the condenser or to the vacuum plant, according to the position of the valve connecting the high and low-pressure casings.

A central surface condensing plant with turbine-driven auxiliaries is installed below the turbines. This is kept continually in service, so that whenever excess steam over the above that required by the vacuum plant is called for by the generating sets, it is efficiently expanded in the low-pressure stages of the turbines. A second smaller surface condenser is being installed to act as a stand-by to that already mentioned; this is being erected on the ground level just outside the engine room.

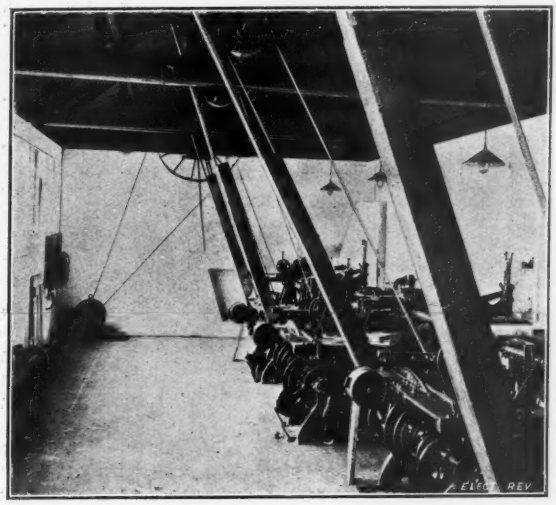
There are some 45 motors installed at the new Weston Point Works, and of these 10 are used directly in connection with the vacuum evaporator; four for operating brine and air pumps; three for the stirrers in the brine pans; and three for the elevators which deal with the salt after it leaves these pans. The size of these motors varies from 12 to 150 H.P., and as it was desired to concentrate their control, as well as the control of the steam to the evaporator, at one point, a special centralised control platform was installed.

This centralised control platform is located at the operating level of No. 1 pan; a totally enclosed Westinghouse type "S" ironclad switchboard is placed on either side of this platform, there being one panel for each of the ten motors. Each panel includes an oil-type circuit-breaker, ammeter, indicating lamps to show when the motor is in operation, and in the case of the panels for the large motors in the pump room, an auxiliary switch for controlling motor-driven liquid starters, by means of which the large machines are started from the central platform. One of these small



Squirrel-cage Motors driving Salt Elevators from Vacuum Pans, Weston Point Works.

motors is shown in the lower right-hand corner of the view on page 379, taken in the pump room. The 150-h.p. motor controlled by the liquid starter, to which this small motor is connected, drives the reciprocating air-pump for the



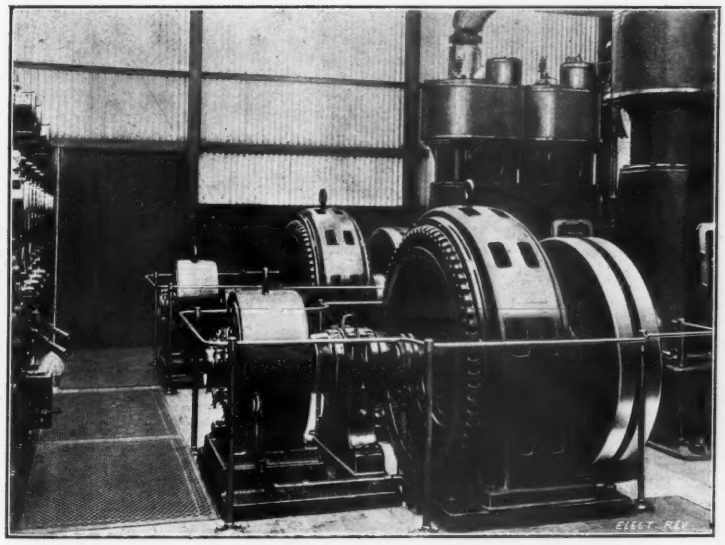
Squirrel-cage Motor driving Paper Bag Making Machinery at the Winsford Works.

vacuum plant. The 100-h.p. slip-ring motor shown at the left of this view drives the centrifugal injection pump, and the 17-h.p. squirrel-cage motor in front of it drives the feed pump for this plant.

The smaller squirrel-cage motors for operating the stirrers and salt elevators from the vacuum pans are controlled by auto-starters mounted on the control platform.

It might be mentioned that the old Western Point Works are driven by direct-current motors. A Westinghouse rotary-converter fed from the power station just described has been installed there to give the necessary direct-current supply.

Our thanks are due to Mr. G. W. Malcolm, chief engineer of the Salt Union, Ltd., and engineer and manager of the Mersey Power Co., and also to Mr. H. L. Riseley, consulting engineer, for the information given in this article, and to the former for permission to take the photographs here reproduced.

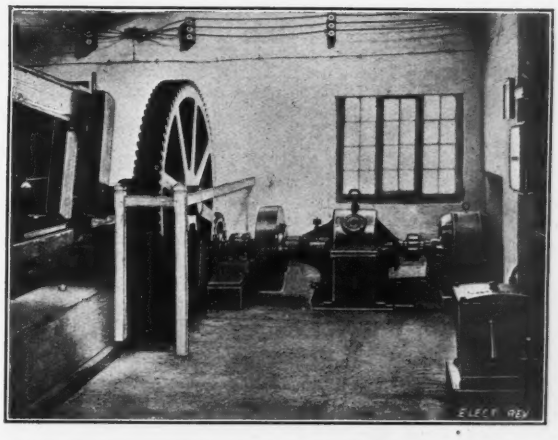


Westinghouse-Browett 375-kw. Three-phase Generating Sets, and Switchboard on the Left, at Winsford Works.

AN 80-TON CANTILEVER CRANE AT EAST COWES.

There has recently been put into service at Messrs. White's shipyard, East Cowes, Isle of Wight, a cantilever crane, manufactured and constructed by Messrs. Babcock and Wilcox, Ltd. The stanchion bases of the tower of the main structure of this crane are exceptionally heavy, and are tied together immediately above the foundations. The structure is braced with ties and struts connecting adjacent legs, there being no diagonal bracing from corner to corner in the horizontal plane. The tower terminates at the top with a mass of heavy girder-work, which carries the roller path and the casting holding the centre pin of the rotating boom. The top and bottom roller paths of the crane are formed of bent joist faced with steel; live cast-steel rollers are used, and the slewing rack is bolted to the web of the bent joist which forms the lower roller path.

The general construction of the boom is shown on page 382, and it will be seen that the two girders forming the boom are braced together crosswise by heavy bracing from a



30-h.p. Squirrel-cage Motor driving Converted Brine Pump through P.P. Reduction Gear, Winsford Works.

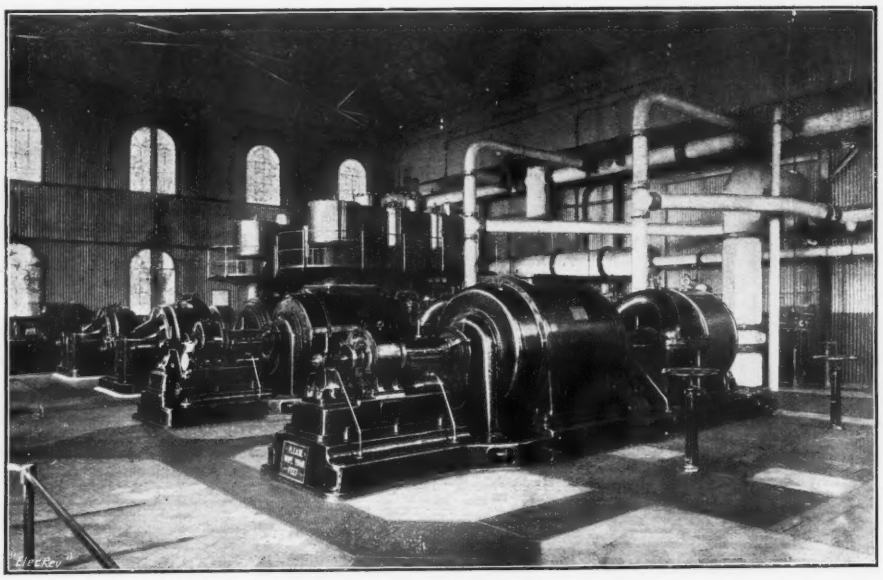
point near the minimum lifting radius, right to the extreme extreme end at which the hoisting gear is situated; they are also tied at the extreme lifting end. The ballast box is situated under the hoisting machinery. The main lifting machinery is situated at the extreme back end of the boom, and consists of two turned and grooved barrels mounted on the same shaft and driven through a suitable train of gearing.

Magnetic and hydraulic brakes are employed for sustaining the load and controlling the lowering motion. Change gear is provided for lifting lighter loads at higher speeds. Each barrel of the crane winds each end of the hoisting rope, which passes from one barrel and is reeved in two folds around the sheaves of the travelling jenny and the bottom block and then round the compensating sheave at the bend of the crane and back round the jenny and bottom block sheaves in two further folds to the other barrel.

Thus the load is lifted on eight falls of rope. The travelling jenny, which is mounted on eight wheels, has a separate motor for travelling, and this drives through spur and bevel gearing to spur racks on each wheel. The auxiliary crab runs in front of the main hoist jenny and is used for lifting loads up to 5 tons.

The slewing gear is mounted immediately above the roller path, and a separate electric motor drives through spur and bevel gear on to the slewing rack. The

operator's cabin is situated at the side of the boom near the edge of the race path.



Westinghouse Turbo-alternators, &c., at Weston Point Works (see page 380).

The large house above this constitutes a housing for the main jenny and the auxiliary lifting crab. A small hand crane travels over the main hoisting machinery and over part of the boom to facilitate operations when the crane is being overhauled. The height of lift from the dock level to the hook at the furthest end of the jib is 75 ft. and the distance from the centre of the crane to the hook in its farthest position outward is 102 ft. 6 in. The loads and speeds vary from 80 tons at a radius of 42 ft. 6 in. to 5 tons at a radius of 102 ft. 6 in., with speeds of 5 ft. per minute on the heavy trolley and 60 ft. per minute on the light trolley, respectively. The time taken to complete one revolution with 80 tons load is three minutes, and with a light load, 1½ minutes.

80-ton Electrical Crane at Messrs. White's Shipyard, Cowes, I. of W. (see page 381).

AN ELECTROLYTIC DETECTOR WITHOUT AUXILIARY E.M.F.

The introduction and successful use of crystal detectors, working without auxiliary E.M.F. and yet detecting Hertzian waves with a sensitivity exceeding that of the usual type of electrolytic detector (in which an auxiliary E.M.F. is employed and carefully adjusted to near the critical value at which electrolysis of the acid solution occurs) has led to the endeavour to realise a highly sensitive electrolytic detector operating without an auxiliary E.M.F. Could such be obtained, it would offer the advantage of being more robust and less easily deranged than crystal detectors, while it would facilitate the investigation of the, at present imperfectly understood, action of crystal detectors.

At the 1909 Congress of the Assoc. Franç. pour l'Avancement des Sciences, an electrolytic detector working without an auxiliary E.M.F. was described, in which the inactive electrode (the cathode) consisted of an amalgam of mercury and tin covering a platinum wire fused through the bottom of the detector tube. The amalgam was the seat of a small auxiliary E.M.F. capable of sensitising the electrolytic cell. This detector was found to be as sensitive as the ordinary electrolytic detector, but a trifle uncertain in action, and subsequent experiments have shown that a mercury-zinc amalgam provides a detector giving uniformly better results than the ordinary electrolytic detector, and one which is eminently suitable for the reception of musical oscillations.

The construction of the new detector, recently described by M. Jégou, is shown in fig. 1. Due to the internal E.M.F. of the cell, current flows from the amalgam (which is slightly attacked) towards the sensitive or active electrode, *i.e.*, in the opposite direction to that in which current flows in the ordinary electrolytic detector when the positive terminal of an auxiliary source of E.M.F. is connected to the active electrode of the detector. This essential difference is responsible for the extreme delicacy of the new detector.

It is necessary to distinguish in an electrolytic detector two critical voltages—the critical anodic voltage, which is

the one usually considered and which corresponds to the auxiliary E.M.F. in such direction that the active point of the detector is the anode; and the critical cathodic voltage which corresponds to the inverse application of current. These critical voltages are determined by the commencement of electrolysis in the cell and correspond to maxima of sensitivity; the cathodic sensitivity (active point as cathode) is often equal to the anodic sensitivity, which is the only one generally considered.

The critical anodic and cathodic voltages vary with the metal constituting the inactive electrode and also with the electrolyte employed; values quoted by M. Jégou are as follows:—

	Critical voltage. Anodic.	Cathodic.
Lead	2·8-2·9	ca. 2·3
Platinum	ca. 2·6	ca. 2·2
Mercury	2·1-2·2	ca. 0·5
Mercury-zinc amalgam ...	2·9	ca. zero
Carbon	2·5	2 0-2·1

The fact that the critical cathodic voltage of Hg-Zn amalgam is zero means that an optimum of sensitivity can be secured without the application of an auxiliary E.M.F. by using this amalgam for the inactive electrode of an electrolytic detector.

Though the amalgam is slightly attacked by the electrolyte, the cell is normally polarised, hence the amalgam need only be replaced at long intervals. As shown by fig. 2, the receiving circuit required is particularly simple. The passage of high-frequency current from the aerial A round the

FIG. 1.

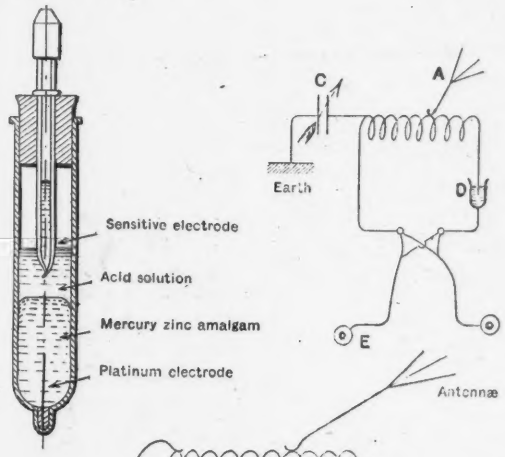


FIG. 2.

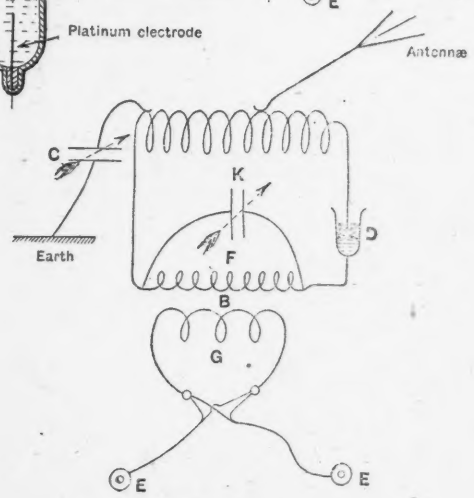


FIG. 3.

ELECTROLYTIC DETECTOR WITHOUT AUXILIARY E.M.F.

detector circuit momentarily depolarises the active electrode of the cell D, and permits the momentary passage of detector currents which produce corresponding sounds in the receivers E. By employing the slightly more complex connections shown in fig. 3, advantage can be taken of secondary resonance in the selection of musical oscillations.

PAYMENT OF INTEREST ON AND OUT OF CAPITAL DURING CONSTRUCTION.

[COMMUNICATED.]

IMPORTANT considerations arise when it is proposed to pay interest on capital (which has been obtained for the purpose of carrying out works) during the period of construction, or the time that intervenes between the date of commencement and the date of completion, usually called the non-revenue earning period.

When we refer to this subject, our attention is immediately directed to the doings of Parliamentary companies, that is, companies incorporated by special Acts, as it is with such special Act Companies that the payment of interest on capital during construction has been directly identified in the past.

The special Act to which they owe their legal existence, and in which are commonly incorporated various sections from the Companies' Clauses Acts, 1845, and any subsequent special supplemental or subsidiary Acts, constitute, it may be said, the Company's Memorandum and Articles of Association.

If the company, alluding entirely for the moment to Parliamentary companies, possesses power to pay interest on capital during construction, it derives its necessary authority from one or more of the clauses in one of its Acts. Such power, however, is usually accompanied by certain restrictions or disabilities, *e.g.*:—

1. The rate is limited to 4 per cent.
2. Interest generally can only be paid for the period authorised for the construction of the works.
3. A certain amount of the authorised or nominal capital must have been subscribed, say two-thirds.
4. It may be provided that notice of the power that the company possesses to pay interest out of capital is to be given in all invitations and documents in connection with obtaining subscriptions on capital account.

Perhaps one of the chief reasons urged for the payment of interest out of capital during construction is simply stated as follows:—

If certain works be constructed and a company wishes to purchase them, the seller in arriving at his cost of them for the purpose of sale would include interest on the capital expended before adding thereto the amount of profit desired. If the company constructed the works and retained them for its own use, is it not correct that any interest paid out of the capital subscribed during construction should be added to the fundamental cost of the property as being part of its total or entire cost?

But let us eliminate the introduction of the incident of purchase and sale, and assume that a Parliamentary company is formed with a capital of £250,000, of which there is issued £170,000, and actually paid up £160,000, that it constructs a certain line at a cost of £150,000, that the work occupies one year, and that interest is paid out of capital for that period.

Here the capital cost of the line is £150,000, and it is undoubted that £6,400, which represents 4 per cent. on £160,000 for the year, does not add to the value of the line. Literally, the £6,400 is simply a repayment to the shareholders of a part of the money which they have subscribed, though legally, of course, it does not operate as a reduction of capital. We, therefore, have:—

Capital cost of line	£150,000
Interest on capital or cost of capital ...	6,400
	£156,400

There are other views of a contrary nature, which we need not enter into here, but which are deserving of equal consideration.

In all such cases it may be argued that the interest represents no asset, and that it should not be included in the capital expenditure account, the accounts of Parliamentary companies being kept on the double account system; but that it should be included distinctly in the general balance-sheet, and written off in much the same way as financial expenses and discounts in connection with obtaining share capital, and money on debentures or debenture stock.

As is well known in the case of a company incorporated under the Companies' Act, where any shares are issued for the purpose of raising money to defray the expenses of the construction of any works or buildings, or the provision of any plant which cannot be made profitable for a lengthened period, the company may pay interest on so much of that share capital as is for the time being paid up for the period, and charge the same to capital as part of the cost of construction of the work, building or plant, provided that the payment is authorised by the articles or by special resolution, and that the previous sanction of the Board of Trade has been obtained, the result being that (1) the payment will be authorised only for such period as the Board of Trade may determine, which period will in no case extend beyond the close of the half-year next after the half-year during which the works or buildings have been actually completed or the plant provided: (2) the rate must not exceed 4 per cent. per annum; and (3) that the accounts of the company must show the share capital on which, and the rate at which, interest has been paid out of capital during the period to which the accounts relate.

This step was not taken until 1907, and, as in the case of Parliamentary companies, the payment of interest in such circumstances does not operate as a reduction of the amount paid up on the shares in respect of which it is paid.

But before 1907 and since, it has been, and is, an act of frequent occurrence for companies to capitalise a proportion of debenture interest paid, whilst works which are under construction cannot be made revenue-earning until after completion.

The usual practice is to show the whole of the debenture interest in the accounts, and the amount transferred to capital account, as

being part of the capital expenditure for the period (as below). In subsequent years' accounts, however, there is no visible record of the capitalisation of debenture interest.

REVENUE ACCOUNT.

Debenture interest	£39,220	
Less proportion of interest charged to properties and works account	10,148	
		£29,072

BALANCE-SHEET.

Tramways and light railways undertakings, property and works, as per last account...	£2,684,826
Add this year new construction works and equipment properties, &c.	220,268
	£2,905,094

The addition to the capital expenditure account includes the £10,148 interest indicated in the revenue account.

Though debentures or debenture stock form no part of the legal capital of a company, our observations in general in relation to Parliamentary companies may be applied when determining the destination of debenture interest in similar circumstances. On the other hand, "we may read that the interest on debentures recently issued was paid out of revenue, although this amount might well have been placed to capital account, as the money obtained by their issue has been expended on a new mill which will not be brought into use until a later period." A thorny problem does the subject, which we have been noticing, raise. So much depends upon the point of view, apart from its legal aspect.

It may be observed that there does not appear to be any provision in the Companies' Acts precluding a company from calling up a certain proportion of its share capital, and accepting the remainder as calls paid in advance, paying thereon interest at the rate presented by the articles.

CONTRACTS OPEN.

(*Continued from page* 378.)

Australia.—September 30th. Insulators at Sydney, Melbourne, Brisbane, Adelaide, Perth and Hobart.

PERTH.—September 10th. For the P.M.G. Nine sections of a trunk line switchboard.

November 12th.—Lamp signalling trunk line switchboard, of five sections, &c.

MELBOURNE.—October 7th. Electrically-driven machinery for operating pneumatic tube services. See "Official Notices" August 22nd.

November 4th.—Automatic switchboards for exchanges in metropolitan network. See "Official Notices" August 22nd.

September 9th.—City Council; electricity meters and maximum demand indicators. See "Official Notices" August 22nd.

September 16th.—For the P.M.G.; a common-battery or an automatic switchboard.

September 16th.—Corporation. 176 yd. 0·25 sq. in. three-core lead-covered cable; 5,471 yd. 0·15 ditto, and 3,500 yd. ·05 ditto. Also three 250-K.V.A. three-phase transformers. See "Official Notices" August 29th.

September 23rd.—Sulphate of copper, for the P.M.G. Specifications from the Commonwealth Office, 72, Victoria Street, S.W.

October 14th.—A common-battery multiple switchboard.

November 4th.—Eight automatic telephone switchboards.

NEW SOUTH WALES.—October 15th. The Government Railways invite tenders for the supply of 13 D.C. motors, to specification No. 412. Specifications are obtainable at the Electrical Engineer's Office, 61, Hunter Street, Sydney (price 2s. 6d. each).

SYDNEY.—October 15th. For the P.M.G.; measuring instruments, telephone parts and switchboard parts. Particulars from the Commonwealth Office, 72, Victoria Street, S.W.

VICTORIA.—November 12th. For the Victorian Railways; flame arc lamps.

P.M.G.'s Department.—September 23rd. General stores for a period of two years, as per Schedule 913.—*Tenders.*

Belgium.—September 17th. Supply and erection of a 25-ton crane, with electric motor and accessories, at the Malines central machine shops. Deposit 1,700 fr. (Cahier des Charges Special No. 1,410 gratis); plan, 0·90 fr. It is advisable to send in tenders by September 13th. Salle de la Madeleine, Brussels.

Bingley.—September 15th. Corporation. Sec. A.—Rotary converters and transformers. Sec. B.—A.C., E.H.T. and L.T. and D.C. switchgear. Sec. C.—Low-tension cables. See "Official Notices" to-day.

Burnley.—September 22nd. The Guardians of the Burnley Union invite half-yearly tenders for the supply of electrical requirements

Canada.—October 1st. Regina City Commissioners require tenders for coal bunkers, ash hoppers, coal and ash conveyors and crushers. Deposit with tender. Specifications, Mr. E. W. Bull, Superintendent of Light and Power, Regina.

Cardiff.—September 12th. Corporation. (1) One 2,000-KW. turbo-alternator, with surface condensing plant and auxiliaries; (2) one 700-KW. rotary converter; (3) boiler house plant. (*a*) Water-tube boilers, super-heaters, stokers, &c.; (*b*) turbine-driven feed pump and heater; (*c*) fuel economiser. See "Official Notices" August 22nd.

Costa Rica.—LIMON.—Installation and working of an electric light service in the city and its suburbs. Plant required: Two 414-H.P. Pelton turbines, two 400-KW. generators, and six transformers. The date when tenders will be adjudicated upon will be settled on September 18th. Particulars and plans from the Ingeneiro Municipal, at Limon.

Dartford.—September 16th. U.D.C. (*a*) Water-tube boiler, economiser, fan, steel chimney and accessories; (*b*) inverted rotaries, transformers, switchboard and cabling. See "Official Notices" August 29th.

Douglas (I.O.M.).—September 15th. Good steam coal (about 521 tons), for the Tramway Department of the T.C. Mr. A. Robertson, Town Clerk.

Edinburgh.—September 8th. Electric light and power installation at the new Town Hall, High Street, Portobello. Particulars from Mr. Newington, electrical engineer, Dewar Place.

September 22nd.—Corporation. Two mixed-pressure steam turbines and direct-current generating plants, each of 1,500 KW. capacity. See "Official Notices" August 22nd.

Germany.—September 20th. The Prussian State Railway authorities at Konigsberg are inviting tenders for the supply and erection of several electrically-operated high-pressure pumps.

Greece.—September 30th. The Harbour Authorities at the Piræus are inviting tenders for the supply and erection of two electrically-operated cranes, one of 10 tons and one of 6 tons capacity.

Lancashire.—September 9th. Tell-tale clocks, telephones, electric clocks and fire alarms, for the Visitors for Whalley Asylum. See "Official Notices" August 22nd.

Leicester.—September 30th. (*a*) One high-pressure steam turbine, direct-coupled to one 3,000-KW. three-phase alternator, together with condensing plant, high and low-tension switchboards, rotary converters, &c.; (*b*) two water-tube boilers, together with fuel economiser, and the necessary steam, feed, blow-off and drain pipes, &c. See "Official Notices" to-day.

London.—L.C.C.—September 23rd. Main high-tension switchgear, including the reconstruction of existing main high-tension switchgear, at Greenwich generating station. See "Official Notices" August 22nd.

HAMMERSMITH.—September 24th. Borough Council. Underground cables, and sub-station switchgear. See "Official Notices" August 29th.

Morocco.—October 13th. The Post and Telegraph authorities in Tangier are inviting tenders for the supply of 177 tons of bronze wire and 20 tons of telephone wire.

New Zealand.—November 12th. Dunedin City Council. Supply of meters, demand indicators, insulated and bare wire for two years. Specifications from Electrical Engineer, Dunedin.

Oldham.—September 17th. Steam coal for the Electricity Committee for three, six or 12 months, commencing October 1st. Specifications and forms of tender obtainable from Mr. S. W. Newington, Electricity Offices.

South Africa.—September 10th. Supply and delivery of electric bed lifts, New Hospital, Port Elizabeth.

Roumania.—September 12th. The municipal authorities of Roshiorlide-Vede are inviting tenders for the concession for the electric lighting of the town.

September 17th.—Lighting of the city of Tetuci with electricity, and construction of a generating station. Provisional deposit 25,000 fr. Offers to the municipality.

Spain.—September 11th. The municipal authorities of Castellon de la Plana are inviting tenders for the establishment of a central electric lighting station in the town, and for the laying of supply mains both in Castellon and De Grao.

September 21st.—The municipal authorities of Saldana (province of Palencia) are inviting tenders for the concession for the electric lighting of the town during a period of 10 years.

Tunbridge Wells.—September 13th. Corporation. Supply and delivery during the ensuing 12 months of high and low-tension cables. Specifications and forms of tender from the Borough Electrical Engineer, Stanley Road, Tunbridge Wells.

Turkey.—Supply of 21,500 insulators with curved iron fitments, 1,350 ordinary iron telegraph posts, 150 iron telegraph posts 6 m. long, 150,000 kg. galvanised iron wire, diameter 2 mm. Imperial Ottoman Post and Telegraph Administration, Constantinople.

Warrington.—September 9th. The B. of G. invites tenders for electrical sundries required at the Workhouse, or the Cottage Homes, from October 1st, 1913, to March 31st, 1914. Forms from Arthur Bottomley, Clerk, Bewsey Chambers.

Whitwood.—September 8th. Electric lighting extension, overhead insulators, for the U.D.C. Specifications, quantities, &c., obtainable from Mr. G. Taylor, Surveyor, Council Offices, Whitwood Mere.

Wigan.—September 20th. Corporation. 1,500-KW. turbo-alternator, ejector condenser, pipework, and all accessories. See "Official Notices" to-day.

CLOSED.

Accrington.—The Electricity Committee has accepted the following:—

·1 sq. in. and ·05 sq. in. extra-H.T. three-core paper lead-covered armoured cable.—Messrs. W. T. Glover & Co., Ltd.
Switch panels at Clayton-le-Moors sub-station and Rishton Paper Mills terminus.—British Thomson-Houston Co.
250-KW. motor converter.—Messrs. Bruce Peebles & Co.
One 100-K.V.A. and one 800-K.V.A. static transformer and one oil switch.—British Westinghouse Co., Ltd.

Australia.—Victorian Railways Department. Miniature electric staff instruments, Messrs. M'Kenzie & Holland, Ltd.

MELBOURNE.—Spare armature for 500-KW. motor-generator, British General Electric Co., £200; insulated copper cables, British Insulated and Helsby Cables, Ltd., £1,361.

PERTH.—The following tenders for Perth power station have been accepted:—

Power station buildings, complete boiler house equipment and other plant.—Babcock & Wilcox, Ltd., £124,424.
Turbo-alternators, transformers and motors.—Willans & Robinson, Ltd., £30,982.
Traction rotary converters.—British Westinghouse Electric and Manufacturing Co., Ltd., £9,863.
Condensing plant, pumps and piping.—Willans & Robinson, Ltd., £23,251.

SYDNEY.—The Municipal Council has been recommended to accept the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for arc lamp carbons, and to purchase supply meters from Messrs. Lawrence & Hanson, Ltd., and from Messrs. Ferranti, Ltd., an additional 2,000 insulators from Messrs. Noyes Bros., fuse boxes and bare copper cable from the British Insulated & Helsby Cables, Ltd., and wood cross-arms from the Hudson Pole Co.

Bacup.—The Electricity Committee has resolved that the tender of Messrs. W. T. Glover & Co., Ltd., be accepted for the supply and laying of about 4,000 yards of ·1 H.T. cable, subject to the same being satisfactory to the consulting electrical engineer.

Barnstaple.—The T.C. has accepted the tender of Messrs. Williams & Co., of Barnstaple, for installing twenty 100-C.P. Osram lamps at the Market, at £29.

Belgium.—La Société Bruxelloise d'Electricité, of Brussels, was the only concern to submit tenders to the municipal authorities of Schaerbeek for the supply of high-tension current. The price quoted was 9 centimes per KW.-hour during the day, and 12½ centimes for night supply.

Bolton.—The Electricity Committee has accepted the following tenders for coal supplies, viz.:—Messrs. J. B. Scholes and Sons, 20,000 tons; Messrs. J. Briggs & Sons, 10,000 tons.

Canada.—The Regina (Sask.) City Commissioners have awarded a contract for a 1,200-KW. motor-generator to Messrs. Bruce Peebles & Co., Ltd., Edinburgh.

WINNIPEG.—The City Council has awarded the Fort Garry Construction Co. the contract for the new terminal power station for the light and power department. The contract price is $35,000.—*Canadian Engineer.*

Dartford.—The U.D.C. has accepted the tender of the Premier Accumulator Co., Ltd., for replating the battery.

Halifax.—The Tramways Committee has accepted the tender of Messrs. Bolckow, Vaughan & Co., Ltd., of Middlesbrough, for the supply and delivery of 200 tons of steel girder rails, and 7 tons of steel fishplates, at £7 per ton, subject to the rails being made in England.

New Zealand.—The Christchurch City Council has accepted a tender for converters, in connection with the Lake Coleridge supply, of Messrs. Turnbull & Jones, at £3,070.

Ramsgate.—The Ramsgate E.L. Co. has secured the order for installing the electric light at the premises of the local Constitutional Club.

Rotherham.—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained, through Messrs. Smith Bros., Rotherham, the yearly contract for the supply of "Tantalum" traction lamps for the Rotherham Corporation Tramways.

Salford.—The T.C. has accepted the tender of Messrs. Halliwell & Co., at £512, for installing electric light in the Police Department at the Town Hall. The following tenders have also been accepted:—

Ferranti, Ltd.—Three-phase to two-phase switchgear, including static transformers, £1,085, plus an amount not exceeding £10 for erecting and connecting regulators.
Switchgear & Cowans, Ltd.—Regulators for above switchgear, £283 10s.

Stalybridge.—The Joint Tramways and Electricity Board has accepted the tender of Mr. Grimson for pipework, and purchased a second motor-wagon from Messrs. Foden's, Ltd., for £521.

Tyldesley.—The Council has accepted the tender of Messrs. A. Hopps & Sons for the supply of lubricating oils for the year ending June 30th next.

Walsall.—Seven tenders were received for the electric lighting plant at the proposed new hospital for the Great Barr Hall Joint Committee, and that of Messrs. Whittaker Bros., Dudley, was accepted, at £680.

Warrington.—The T.C. has accepted the following tenders for supplies to the electricity and tramways departments:—

British Thomson-Houston Co., Ltd.—Feeder panel, £84.
Albion Clay Co., Ltd.—Annual supply of conduits.
Underfeed Stoker Co., Ltd.—Patent underfeed stoker, with forced-draught fan and motor, £258.
Veritys, Ltd.—Motor-generator, £52 10s.

The Premier Accumulator Co.'s tender has been accepted for the battery, booster and switchboard plant for the Corporation tramways.

FORTHCOMING EVENTS.

British Association.—September 10th to 17th. Meeting at Birmingham.

Junior Institution of Engineers.—Saturday, Sept. 13th. At 10.30 a.m. Visit to the works of Messrs. R. Waygood & Co., Ltd., Falmouth Road, London, S.E.

NOTES.

The Artificial Lighting of Schools and Libraries.—The preliminary report of a Joint Committee appointed in 1911 was recently issued by the Illuminating Engineering Society, from which the following extracts have been made: It is suggested that (*a*) for ordinary clerical work (reading and writing, &c.) the minimum illumination measured at any desk where the light is required, should not fall below 2 ft.-candles; (*b*) for special work (art classes, drawing offices, workshops, and stitching with dark materials, &c.) a minimum of 4 ft.-candles is desirable; (*c*) for assembly rooms, &c., and for general illumination a minimum of 1 ft.-candle measured on a horizonal plane 3 ft. 3 in. from the ground.

It was also recommended, in view of the general recognition of the prejudicial effect on the eyes of children of fine needlework carried on by artificial light, that only coarse work on white material should be executed by artificial light in elementary schools; the minimum in this case being the same as for (*a*) above.

The Committee decided that the above standards of illumination should be provisionally adopted, irrespective of the method of lighting.

The Committee recommends that an illumination on the blackboard, about 60 per cent. in excess of that prevailing in the rest of the room, is desirable.

As a rule, it would be necessary for the illumination on the blackboard to be carried out by special local lighting from lamps equipped with opaque screens, completely concealing them from the eyes of students.

It is a common defect in schoolrooms for the bare mantles or filaments to be within the range of vision of students when looking towards the blackboard. The Committee recommends that no lamps should come within the solid angle subtended at the eye by the blackboard and a space 2 ft. above it, unless they are completely screened from the eye by a shade impervious to light. In general it is desirable that no incandescent surface should be visible to the eyes of students or teachers, while carrying on their ordinary work.

The Committee advocates the use of shades in which the brightness of the source is spread out over a considerable area, and the judicious use of reflection from the walls and ceilings of the room. These should be of such a texture that any considerable regular reflection is avoided, glazed and shining surfaces above the dado being specially objectionable.

In the class-room the lights should be so arranged, that inconvenient shadows cast by the body on the desk are, as far as possible, avoided. The ceilings should be preferably of a warm white colour, and the walls and all woodwork above the dado should be light in tint.

Dealing with the artificial lighting of libraries, the Committee makes the following recommendations:—

1. *Table, Desk, or Newspaper Stand Lighting.*—The illumination where the light is being used should in no case be less than 2 ft.-candles. This value is understood to apply to reading ordinary type printed on white paper. When books printed in small type, or manuscripts, or surfaces having a low reflecting power are to be studied, a higher illumination is necessary, and a tentative value of not less than 5 ft.-candles is suggested.

2. *Book-case and Shelf Lighting.*—A minimum vertical illumination on the case or shelf of ½ ft.-candle.

3. *General Illumination.*—A minimum of ½ ft.-candle. Local illumination should be measured on the desk, slope, or table where reading is carried on. Measurements of general illumination should be made on a horizontal surface, 3 ft. 3 in. above the ground. In all cases the illumination to be expressed in foot-candles.

The Committee emphasises the importance of adequate methods of shading, with a view to avoiding glare from illuminants such as is apt to be trying to the eyes of readers. The filament of an electric lamp or an incandescent gas mantle should not be visible to the reader.

One of the disadvantages of arranging lights close to a reader is the production of troublesome reflections from the glazed paper, or from the tables. The position of lights should, therefore, be selected in such a manner that no rays are reflected *directly* off the polished surface of the paper into the eyes. It is also desirable, as a means of minimising this defect, that the source of light should be extended over a considerable area (either by means of suitable methods of screening, or by making use of the reflection of lights from white or light-tinted walls and ceiling).

Harmful shadows, particularly those thrown by the readers themselves, should be avoided by suitable arrangement of the lights.

Local lighting and general lighting have both their respective merits, but in general a combination of the two methods is most advantageous.

The International Illumination Commission.—The International Photometric Commission—sometimes spoken of as the Zurich Commission—held a session in Berlin from August 27th to 30th. This Commission was founded in 1900 by representatives of the gas industries of America, Austria, Belgium, France, Germany, Great Britain, Holland, Hungary, Italy and Switzerland, and has occupied itself up to now mainly with technical matters having a direct bearing on the gas industry. It has, however, been widely felt for some time, both inside and outside the Commission, that international matters relating to illumination should receive consideration by a body which is representative of electric and other interests, besides that of gas. This object might have been achieved by the formation of an entirely new international body, but it has happily been found possible so to enlarge and reconstitute the existing Photometric Commission, that it will now be representative in the broadest sense of all institutions and societies associated with the science or practice of illumination. The range of work is to be as wide as the subject of illumination itself, saving only those phases which may be described as commercial rather than technical.

The affiliated gas societies having previously agreed to the enlargement of the Commission, a very representative number of delegates, totalling 45 from all the affiliated countries, met in Berlin last week to discuss and agree upon the new statutes of the enlarged Commission.

The British delegates were Dr. Colman and Mr. Butterfield, from the Institution of Gas Engineers; from the Institution of Electrical Engineers, the President, Mr. Duddell, and Mr. Edgcumbe; from the Illuminating Engineering Society, Mr. Gaster and Mr. le Maistre; and Mr. C. C. Paterson from the National Physical Laboratory. Well-known delegates from other countries included Drs. Hyde, Kennelly, Bell and Sharp, from America; M. Vautier, the President of the Commission, Drs. Broca, Bünte, Brodhun, Prof. Feltman and many others.

After four days' discussion and hard work the new statutes were unanimously agreed upon, and it speaks well for the future of the Commission that the earnest desire to co-operate internationally in the cause of good lighting was strong enough to reconcile and harmonise so many divergent interests, both technical and national.

The Commission is now to be called "The International Illumination Commission." Representation is to be through the medium of National Committees on Illumination in all countries affiliated with the Commission. Each country has only one vote in all international decisions irrespective of the number of delegates sent, and the contribution from all countries is to be identical in amount.

Perhaps the greatest step forward from the point of view of international bodies, is on the language question, since one language (French) has been made the basal language in which all formal resolutions and documents are drafted and published. Translations from the French may be made into any language by a National Committee, but such translations are only of secondary importance. English, French and German are allowed in all discussions, in which the assistance of an interpreter will, of course, be required.

Arrangements were made at the close of the meeting for appointing Committees to consider various technical subjects, so that the real work of the Commission may begin as soon as the new constitution has been approved by the bodies which appointed the delegates.

The officers of the Commission, elected for three years, are the president, treasurer and hon. secretary, assisted by a paid secretary.

Mons. Vautier, of Lyons, was elected first President, a recognition of his arduous work as President of the old Commission. Herr Weiss, of Zürich, becomes treasurer, and Mr. C. C. Paterson, of the National Physical Laboratory, was elected hon. secretary, so that the Bureau of the New Commission will be located in London. The vice-presidents are Drs. Bünte, Hyde and Kusminsky.

The satisfactory result of the Berlin meeting was only achieved after much preparatory work by individuals in all the countries concerned, and by the sincere desire of the delegates to reach a solution which would generally be acceptable in all countries.

Trade with South Africa.—The London Chamber of Commerce is informed that in view of Secs. 102 and 103 of the Regulations under the South African Union Customs Management Act of 1913, invoices for goods shipped to South Africa must contain, in addition to the invoice value, a statement of the "current value for home consumption in the open market for similar goods at the place of purchase." The following is a copy of the Sections referred to:—

102. "The value of goods for Customs duty purposes shall be ascertained by a declaration at the foot of the appropriate bill of entry in the manner and form as follows:—

"I, the undersigned, ..., for importer, do hereby declare that the above is a true description and complete return of all goods contained in the above-mentioned packages and of the value of such goods, and that values are the true current values of same as defined by law, including the cost of packing and packages."

103. "The person entering goods at importation shall produce, if required by the proper officer of Customs, any document relating to the goods, and the invoice shall contain a statement in a prominent place made by the suppliers showing clearly the current value for home consumption in the open market for similar goods at the place of purchase bought in the ordinary manner from the manufacturer or supplier in normal quantities. The invoice and any covering statement shall also clearly show cost of packing and packages."

It has been suggested by the Durban Chamber of Commerce that the form of invoice in use in connection with shipments to Canada would meet the requirements of the South African Customs.

Fatalities.—An employé of the Yorkshire Electric Power Co. has died at the Dewsbury Infirmary as a result of injuries sustained at the Thornhill Power Station. It appears that the deceased—Samuel Hague, 49 years of age—was striding over a coal conveyor to get to the engine house, when he was caught in the machinery and sustained fearful injuries, which caused his death. At the inquest it was stated that it was a habit of the employés to stride over the conveyor instead of using the steps provided. A short time ago another man was injured through neglecting to use the steps, and an additional set of steps was then provided, together with an emergency switch to stop the machine in case of accident. Since this last accident, the conveyor has been fenced over so that the employés will, perforce, have to use the steps. A verdict of "Accidental death" was returned.

At the resumed Coroner's inquest at Eastwood, Nottingham, on Edwin Spaulton (31) and Edward Clarke (30), who were killed by electric shock at Moor Green Colliery while engaged in working a coal-cutting machine, the Coroner criticised the method of examination, and expressed the opinion that such workmen should have some kind of training.

Mr. Routledge, chief electrician, said he found a defect in the controller switch and a burned-out earth connection, which together accounted for the machine being alive. Mr. Nelson, Inspector of Mines, agreed with this explanation, and said it was a purely accidental occurrence which could not be guarded against. A juror suggested that such machines should be fenced in, as was required by the Factory Act, and the jury found that the men were accidentally killed.

On Friday last, when a labourer was engaged with a plumber in laying a water connection at Bonnybridge School, he struck the underground electric cable and was instantly killed.

Thomas Everritt (37) was killed on Monday in the bleach works of Messrs. Stevenson, McKellar & Co., Pollokshaws. A fellow workman found him dead with the "live" wire in his hand. He was in a standing position near a dynamo.

Educational Notes.—East London College.—Special facilities for research in electrical engineering are provided at this College on four evenings a week.

West Ham Municipal Technical Institute.—Full courses in electrical engineering, day and evening, are provided.

University College, Nottingham.—The next session of the department of electrical engineering opens on September 29th.

Particulars of the above are given in our advertisement pages to-day.

Electric Workers' Strike in Russia.—Two thousand five hundred workmen of the Allgemeine Elektrizitäts Gesellschaft at Riga ceased work last week.

Australian Wireless Stations.—Under an order by the High Court, representatives of the Marconi Co. have inspected the Commonwealth's wireless stations at Melbourne, Hobart, and Brisbane for the purpose of ascertaining whether there has been any infringement of the company's patents.

Legal.—X.L. Co.'s AFFAIRS.—On behalf of the debenture-holders in the X.L. Electric Co, application was made to Mr. Justice Astbury, sitting as Vacation Judge, on Wednesday, September 3rd, for leave to serve notice of motion for the following week for an injunction. Counsel stated that Mr. Aron, a director, was under an order and undertaking to do all things necessary for the carrying on of certain proceedings before the Comptroller of Patents, but a meeting of the company had been called at which a resolution had been passed to abandon those proceedings, and notice of that resolution had been sent to the Comptroller. Such a resolution was in breach of the order and undertakings, and was prejudicial to the rights of the Receiver who had been appointed in the debenture-holders' action. Under these circumstances, he asked for leave to serve notice of motion for the following Wednesday to restrain the company from acting on the resolution and from sending notice of it to the Comptroller.—His Lordship gave the required leave.

OSRAM LAMP PATENT CASE.—On the same day, counsel applied on behalf of the plaintiffs in the action of the Osram Lamp Works, Ltd., *v.* William Glenn & Co., for an interim injunction to restrain until the trial or further order an alleged infringement of their patents. He stated that the injunction he asked for was in respect of two patents which had already been the subject matter of an action tried in 1912. Mr. Neville, for the defendants, submitted that the plaintiffs could not be entitled to any injunction; the patents sued upon were for a squirted filament as distinct from a drawn filament, and he admitted the sale of the lamps alleged to be an infringement, but he had evidence that the filament in them was not a squirted filament, but a drawn-wire filament. His Lordship said that on that evidence he could not grant an interim injunction. Counsel for the plaintiff said he desired to cross-examine the defendants' witness, who was not a manufacturer; he said he believed the lamps in question had a drawn filament, but the plaintiffs desired to have the grounds for that belief. His Lordship said that on the evidence as it stood he could not grant an interim injunction, and on the defendants' undertaking to keep an account of the lamps sold in the usual way, there would be no order on the motion.

Appointments Vacant.—Lecturer in electrical engineering for the University of Queensland, Australia. Salary £350 per annum, less 7½ per cent. deduction for the purchase of an endowment assurance policy in favour of the lecturer; junior switchboard attendant, Salford (26s.); electrical engineer for the Leek U.D.C., to take charge of electricity undertaking (£225-£275); shift engineer at the Stuart Street generating station, Manchester, (£175); switchboard attendant (25s. to 30s.), for the Portsmouth Corporation; testing assistant for Pendleton (26s.). See our advertisement pages to-day.

Inquiry.—Agents for the "Vita" heaters are asked for.

Disclaimer.—Messrs. Wm. Wadsworth & Sons, Ltd, lift and transporter makers, Bolton, wish to announce that they have absolutely no connection whatever with the Wm. Wadsworth, 16, John Dalton Street, Manchester, referred to in our issue of 22nd ult. in connection with "Bankruptcy Proceedings."

Exhibitions.—The Sheffield Fuel, Light and Power Exhibition, which opens on October 24th next, has received the approval of the B.E.A.M.A., and will afford a good opportunity for showing electric lighting, cooking and other apparatus.

Next year there will be a Universal Exhibition at Nottingham, and an Anglo-American Exposition at Shepherd's Bush, London, both from May to October. Interesting particulars regarding all these coming events have come to hand as we go to press, and will be dealt with in our next issue.

The Strike in London.—At the time of going to press, no change had taken place in connection with the strike of painters and electricians employed by the Office of Works. The strike committee of the electricians on Wednesday issued a sensational statement regarding the alleged dangerous condition of the wiring in the Premier's residence.

Iron and Steel Institute.—The autumn meeting of the Institute was held at Brussels on Monday and Tuesday this week. Amongst the papers read was one by Mr. Otto Frick on "The Electric Refining of Steel in an Induction Furnace," of which we shall publish an abstract in a later issue.

Railway Disaster.—A collision took place on Tuesday morning on the Midland Railway, near Aisgill, between two express trains. Fourteen lives were lost, and three wrecked coaches were burnt to ashes. We refer to the matter in our leading columns to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Bridlington T.C., on August 28th, confirmed a resolution to increase the salary of the electrical engineer, MR. A. J. BECKETT, from £350 to £375 per annum, as from January 1st, 1914.

The York Electricity and Tramway Committee has appointed MR. J. J. SMITH as installation superintendent at the electricity works, at a salary of £120 a year, rising by £10 per annum, to a maximum of £150.

MR. W. CORIN, chief electrical engineer, N.S.W. Public Works Department, is visiting this country, as well as the Continent and America, with a view to studying bulk supply and transmission questions on behalf of his Government.

The marriage took place at Milnsbridge, last week, of MR. SAM DAWSON, younger son of Mr. W. W. Dawson, of Milnsbridge, and who is on the electrical staff of the Leicester Corporation, and Miss Mary Hanson, of Golcar. They received many valuable presents.

General.—On completing half a century's service with Messrs. Siemens Bros. & Co., Ltd., of Woolwich, S.E., MR. ABRAHAM JAMES PEMBERY, of the india-rubber department, has been presented by the firm with a bag of gold, and by the staff and employés with a gold watch and chain, and a gold mounted umbrella for Mrs. Pembery.

MR. R. W. WILLIS has resigned his position as chief assistant electrical and mechanical engineer to the Swindon Corporation, and is joining Mr. R. A. Smith as principal assistant in his consulting practice at Westminster.

MR. C. LUCKEN, who for the past five years has been engineer-in-charge to Messrs. Siemens Bros. & Co., Ltd. (Tantalum Lamp Works), Tyssen Street, Dalston, has resigned this position to take up a similar appointment with the Hong-Kong and Shanghai Banking Corporation, Gracechurch Street. The new bank buildings are being fitted with most up-to-date plant representing some of the latest developments in electrical and mechanical engineering. Mr. Lucken was presented with a solid marble clock by his colleagues as a token of their continued good wishes.

Obituary.—MR. C. T. HARGREAVES.—Intelligence has reached Blackpool of the death by electric shock at Santos, Brazil, on August 23rd, of Mr. Christopher Thomas Hargreaves, son of Mrs. Hargreaves, of Blackpool. Mr. Hargreaves, who was formerly an electrician in the tramway department at Blackpool, was engaged at Santos with the City Improvements Co., of London. He was only 29 years of age.

MR. H. S. JACQUES.—The death has occurred in the West Cumberland Infirmary, after an operation, of Mr. Henry S. Jacques, who was in business as an electrical engineer in Tangier Street, Whitehaven.

NEW COMPANIES REGISTERED.

John Fowler & Co. (Sydney), Ltd. (130,819).—This company was registered on August 28th, with a capital of £20,000 in £10 shares, to acquire the goodwill of the branch business carried on by John Fowler & Co. (Leeds), Ltd., at Sydney, N.S.W., and to carry on the business of mechanical, civil, hydraulic and telegraph engineers, millwrights, machinists, iron and brass founders, metal workers, makers of, and dealers in, steam engines and boilers, steam ploughs and cultivating machines and apparatus, manufacturers of, and dealers in, wire, cables and appliances used in connection with electric telegraphs and lighting, contractors for the execution of works in Australia, New Zealand, or elsewhere, &c. The subscribers (with one share each) are:—A. Fowler, 113, Cannon Street, E.C., engineer; W. McIntosh, 113, Cannon Street, E.C., engineer. Private company. The number of directors is not to be less than two or more than four: the first are R. H. Fowler, A. Fowler and W. McIntosh. Registered office, 113, Cannon Street, E.C.

Jones, Burton & Co., Ltd. (130,820).—This company was registered on August 28th, with a capital of £15,000 in £1 shares, to take over the business of mechanical and consulting engineers, carried on at Liverpool as "Jones, Burton & Co.," and to carry on the business of mechanical, electrical, consulting and inspecting engineers, contractors and manufacturers of, and dealers in, railway, tramway, magnetic, manufacturing and other plant, machinery and apparatus, &c. The subscribers (with one share each) are:—G. L. Burton, 19, Castle Street, Liverpool, engineer; R. Fynes-Clinton, 19, Castle Street, Liverpool, engineer. Private company. G. L. Burton is entitled to act as governing director, and shall have power to appoint other directors; qualification of first directors, 1 share; of subsequent directors, 100 shares; solicitors, Sampson, Williamson, Inglis & Edgecombe, 35, Dale Street, Liverpool. Registered by T. T. Hull & Son, 22, Chancery Lane, W.C.

Auto-Flash Sign Co., Ltd. (130,829).—This company was registered on August 29th, with a capital of £1,000 in £1 shares, to carry on the sole or part agency in the United Kingdom, India, Canada, Cape Colony, Australia, New Zealand, and elsewhere, for the business of manufacturers of, and dealers in, electric signs, novelties and other articles now, or to be, manufactured wholly, or in part, or dealt in by Messieurs Riex & Co., of Paris. The subscribers (with one share each) are:—J. McGill, 95, Elliescombe Road, Charlton, S.E., engineer; M. Honnert, Alexander Villa, Etchingham Park Road, Finchley, N., merchant. Private company. Table "A" mainly applies. Registered office, 83-85, Farringdon Road, E.C.

Cayenne Motors, Ltd. (130,749).—This company was registered on August 22nd, with a capital of £5,000 in £1 shares, to take over the business of an electric and automobile engineer and maker and repairer of, agent for and dealer in auto cars and motor-cycles carried on by H. E. H. Hayes at 159, Bexhill Road, St. Leonards-on-Sea, as "Hayes & Co." The subscribers (with one share each) are:—H. E. H. Hayes, Drayton Lodge, Ninfield, Battle, gentleman; J. R. Hayes, Drayton Lodge, Ninfield, Battle, motor engineer; L. Hubbard, Sackville Chambers, Bexhill-on-Sea, solicitor. Private company. The number of directors is not to be less than two or more than five; the first are H. E. Hayes, J. R. Hayes and L. Hubbard; qualification, £1. Registered office, 159, Bexhill Road, St. Leonards-on-Sea.

Dromore Electric Light and Power Co., Ltd. (4,040).—This company was registered in Dublin on August 22nd, with a capital of £3,000 in £1 shares (1,000 preference), to carry on the business of an electric light and power company. The subscribers (with one share each) are:—G. Allen, 35, Queen Street, Belfast, electrical engineer; J. Graham, Dromore, Co. Down, contractor; H. P. Grosse, 35, Queen Street, Belfast, electrical engineer. Private company. The number of directors is not to be less than two or more than seven; the first are J. Graham, G. Allen and H. P. Grosse; qualification, 50 ordinary shares. Registered office, 35, Queen Street, Belfast.

Climax Rock Drill and Engineering Works, Ltd. (130,833).—Registered August 29th, by Downing, Handcock, Middleton & Lewis, Crosby Buildings, E.C. Capital, £60,000 in £1 shares. Objects: To acquire any interest in letters patent, brevets d'invention, licences, concessions, or the like, to carry on the business of gas, electrical and mechanical engineers, manufacturers of and dealers in gas-making, electrical and other machinery and appliances, rock drill manufacturers, sellers and contractors, tool makers, brassfounders, metal workers, boiler makers, millwrights, machinists, iron and steel converters, &c., and to adopt an agreement with W. C. Stephens, carrying on business as R. Stephens & Son, for the acquisition of certain patents, rights and property referred to therein. The signatories (with one share each) are:—A. E. Clutterbuck, 37, Lawrence Road, South Ealing, W., clerk; H. Evans, 16A, Ivydale Road, Nunhead Road, S.E., accountant. Private company. The first directors (to be not less than two or more than five) are A. E. Clutterbuck and H. Evans (provisional directors); qualification, 300 shares; remuneration as fixed by the company.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bristol Tramways and Carriage Co., Ltd.—Acknowledgment of indebtedness dated August 19th, 1913 (supplemented to trust deed dated January 24th, 1908), to secure £125,000 deb. stock in addition to and ranking *pari passu* with £250,000 like stock issued under principal deed, charged on certain freehold and leasehold property in Bristol, &c., and the company's undertaking and property, present and future, including uncalled and unpaid capital. Trustees: Sir George White, Bt., Cotham House, Bristol, and S. White, Dorset House, Clifton.

Lobito, Benguella and Catumbella Electric Light and Power Co., Ltd.—Supplemental trust deed dated July 31st, 1913, to secure £7,500 6 per cent. pre prior lien deb. stock, charged on certain premises and company's other assets, present and future, including uncalled capital. Trustees: Rt. Hon. Lord Waleran, P.C., 44, Hans Mansions, S.W., Bradfield, Cullompton, Devon; and Rt. Hon. Lord Rotherham, Broughton, Lancs., and 61, Queen's Gate, S.W.

Aero Fire Alarm, Ltd.—Assignment dated August 13th, 1913, to secure £1,000, charged on certain contracts, full benefit thereof and moneys payable thereunder. Holder, Sir Arthur Cory-Cory Wright, Bt., 52, Mark Lane, E.C.

Pernambuco Tramways and Power Co., Ltd.—Particulars of £1,250,000 debentures, created July 24th, and secured by trust deed, dated August 11th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the whole amount being now issued. Property charged (specifically): Tramway and gas undertaking and other real or immovable property in Brazil and its share interest in La Companhia Ferrocarril de Pernambuco (as a floating security) the company's undertaking and property, present and future, including uncalled capital. Trustees: A. P. Henderson, 28, Austin Friars, E.C., and Capt. C. S. Schreiber, Marlesford Hall, Wickham Market.

ELECTRICAL TRAIN DISPATCHING ON THE RHYMNEY RAILWAY.

THE handling of railway train movements is a most important function in the proper control of traffic, especially in areas where minerals and goods traffic is large and complicated. In the coal-mining areas of South Wales, therefore, it is not to be wondered at that a very complete and efficient system of train dispatch by telephone has been installed by the Rhymney Railway Co. Both the telegraph and the telephone are already employed by many railways to deal with traffic control, but the Western Electric Co.'s system, introduced by Messrs. J. B. Saunders & Co., Ltd., of York Street, Westminster, upon the railway mentioned possesses features not found in other systems, and it may therefore be interesting to briefly describe the system. The control of the traffic, either on the whole of the railway line or on a certain section, is usually entrusted to one man, known as the controller, whose office is placed at some important point on the route. From this office a pair of wires run alongside the line to the signal cabins and other points where traffic is dealt with. At these points telephones are looped across the wires. These telephones are equipped with a selector, the use of which will be mentioned later. The controller wears a head receiver and a transmitter placed on the chest, and thus he is able to receive and transmit messages while at the same time having his hands free.

In front of the controller is a cabinet fitted with a number of keys or switches, each key being associated with one of the signal boxes or way stations with its telephone set and selector. The keys are so arranged that when they are actuated they send a series of impulses along the line, the current being supplied by a battery fitted at the controller's office. The number of impulses sent out differs with each key, the keys being adjustable so that the required number of impulses may be sent. The selector fitted at the signal box or way station consists essentially of an electro-magnet fitted with an armature actuating a small pawl, which in turn rotates a small ratchet wheel. The latter is fitted with an adjustable contact, so arranged that this contact is closed after a certain number of teeth have been rotated. The operation of one of the keys results in sending a series of impulses along the line, and each of these impulses causes the armature of the selector to be pulled up and then released, and each time that the armature is pulled up it actuates a stepping pawl, and sends the ratchet wheel forward one tooth. All the selector ratchet wheels along the line operate at the same time, but as each of them has its contact set at a different point, after a definite number of impulses have been sent out, and the ratchet wheels come to rest, only one of them has its contact closed, and thus the ring is given to the required station. The ratchet wheel is locked in one direction by a retaining pawl during the time that the current impulses are passing along the line, by an arrangement of the electrical circuit, and hence the wheel can be stepped forward tooth by tooth, but cannot fall back at the time the stepping pawl returns to engage with a fresh cog. When the ratchet wheel has been stepped round to the correct position, contact is made and the bell rings. All the ratchet wheels then fall back to their normal positions, ready for a fresh call, the whole of these movements being made very rapidly, and with great certainty.

The problem of efficient speech transmission over the lines has been solved by devising special telephone circuits, so that as many as 40 telephones can be looped across one pair of wires, and anyone speaking at one station can be perfectly heard at all the others. This special telephone circuit has made it possible to provide a general call scheme for giving simultaneous daily instructions to all the way stations. This general call scheme is arranged as follows:—In addition to the contacts on the selectors already described, a second contact is fitted on each set at the same position on all selectors, as, for example, on the 40th tooth. At the controller's office an extra key is fitted, this key sending out the required number of impulses, in this case 40. On operating this key, all the selectors pass through 40 teeth, and all the contacts for the general call are made so that the bell in each station rings.

For speaking to the controller it is only necessary for the man in one of the way stations to remove the receiver from the hook and to listen, to find whether the line is already used. If not, he can speak directly to the controller, as the caller always has his telephone connected across the line. If the controller is not always listening on the line, a magneto bell can be fitted in the controller's office, the way stations being supplied with hand magneto-generators.

Another interesting addition which is often made to this system is the fitting of a time-sending scheme, each selector being fitted with an additional contact, which is made when the ratchet wheel has rotated a complete revolution. The controller uses this for sending out signals for the regulation of clocks, &c., and by simple modifications of the circuit, this type of selector system can be made to serve other useful purposes in connection with railway working.

In conjunction with the apparatus described above, the Rhymney Railway Co. have installed immediately in front of the controller a table, on which is fixed a diagram board of the whole railway, showing the up and down lines respectively. On this board the movements of all engines and trains are recorded by the controller from time to time as advice reaches him, by the sliding of brass disks bearing the number of the particular train, from position to position. Provision is made in the diagram board at the more important junctions, stations and sidings for sliding the disks from the grooves representing the running roads into side tracks when the engines are detained, shunting, and so on. In order to carry this scheme out, the controller has to be supplied with information as each engine picks up or puts off traffic at the various junctions, and he can at any moment see the exact position of all the trains working throughout the railway. In this way he is able to direct engines to any particular point where traffic is awaiting clearance, or prevent them from making unnecessary journeys to points where traffic which was expected is not in readiness for being moved forward.

The advantages of this interesting method of train dispatching are so obvious, that it is surprising that American practice has not been more speedily followed, and there is no doubt that now that the lead has been given, the matter will receive very careful consideration by other traffic managers. We are indebted to the courtesy of the general manager of the Rhymney Railway and to Messrs. J. B. Saunders & Co., Ltd., for the information given in this article.

CITY NOTES.

Metalite, Ltd.

AN adjourned ordinary general meeting of the shareholders of the above company was called for Friday last, at 22, Christopher Street, Finsbury, at 11 o'clock, but shareholders who presented themselves shortly before the appointed time were told that the meeting would be held at the registered offices of the company, 9 and 10, Pancras Lane, Queen Street, Cheapside, as permission to meet in Christopher Street had been denied the directors at the last moment. It was 11.30 before the proceedings actually commenced, when there were present, in addition to Mr. W. Stewart, who presided, the directors, Mr. Harrison and Mr. Moore, and the representative of the ELECTRICAL REVIEW.

The SECRETARY explained that the reason the meeting was being held at Pancras Lane was that the company's premises at Christopher Street were held under a sub-tenancy, and the board had been unable to get possession to hold the meeting. It was, therefore, deemed advisable to hold the meeting at the registered offices, and to postpone it until half an hour after the proper time, in order to give shareholders an opportunity of getting from one place to the other.

MR. HARRISON asked whether the adjournment had been arranged without giving notice to the shareholders.

The SECRETARY replied in the affirmative, and said it was not until the previous day that he learned they would not be able to get possession of Christopher Street. Of course the inconvenience

which shareholders had been put to was much to be regretted, but he believed that every shareholder who had presented himself at Christopher Street was present.

MR. HARRISON said it was not so, as two shareholders who he saw go to Chistopher Street, were not then present. He and Mr. Moore had signed the attendance book under protest, as they did not consider the meeting legal. He also complained that the directors had not fulfilled the promise they made at the last meeting to send round to the shareholders, within 14 days, particulars of the scheme of reconstruction they were arranging.

The CHAIRMAN said he would deal with that matter in his speech. Continuing, he said the meeting was simply a third formal adjournment of the annual general meeting of the company, nominally to enable the directors to present the balance-sheets and accounts of the company, but the position, as they had already been informed at previous meetings, was that the Receiver was still in possession, for the first mortgagees and the directors had no funds wherewith to defray the cost of preparing such balance-sheets and accounts and having the same audited. At the last adjourned meeting the outlines of the scheme of reconstruction were given to those present, with the intimation that the directors hoped to be in a position to put it before the general body of creditors within a short time of that date, and it was also stated that they were in active negotiation with a group of financiers to provide a considerable sum of money, and thus obviate having to call on the shareholders for so large an amount as would be required. However, these negotiations had now fallen through, and the directors had instructed the solicitors acting for the various parties to complete a scheme so that the same could be put forward at the earliest possible date, therefore giving the shareholders an opportunity to save their property. The directors had been able to arrange that holders of the series of debentures, of which some £18,100 had been issued, should accept shares in the new company. This was a very considerable step towards preparing financial arrangements for the future. It was hoped to have sent prints of the scheme to all shareholders immediately after that meeting, but they had that morning received a letter dated the previous day from two firms of solicitors, one acting for the company and the other for the vendors, wherein they stated that it would be impossible to settle the matter, as counsel who was advising could not be back at his chambers until the middle of September. He must, therefore, ask them to have a little more patience under these difficult circumstances, and would move: "That this meeting do stand adjourned until Thursday, October 30th, 1913, at this office at 11 forenoon."

MR. LEE formally seconded the resolution.

MR. HARRISON said he wished to propose as an amendment that the meeting be further adjourned, and to register his protest that anything done there would be *ultra vires*.

MR. MOORE, in seconding the amendment, said it was high time that the directors took the shareholders into their confidence. These continued adjournments were simply dallying with them, and he felt confident that when October 30th came, they would be in exactly the same position. It was absurd to call that sparsely-attended gathering a meeting of shareholders. He thought it was quite time that the shareholders were circularised and called together properly.

MR. BENTLEY said that as soon as the scheme was settled a print of it would be sent to all the shareholders. The adjournment was only a formal thing, and the complete scheme would be in the shareholders' hands before the end of next month.

The SECRETARY said he saw that the representative of the ELECTRICAL REVIEW was present taking notes. He had a private letter from the solictors acting in regard to the scheme, which he would read to the meeting if the representative would agree not to publish it. Our representative said he was unable to give this pledge, and accordingly the letter was not read.

MR. HARRISON said the trouble was that the shareholders were unable to give the directors any assistance, as they were absolutely in the dark. They knew nothing of what had been done. He was a shareholder for about 5,000 shares, which was a very considerable holding, and he thought they were fairly entitled to know what the directors were doing.

MR. MOORE said that directly and indirectly he represented about 150,000 shares, and he could assure the directors that the shareholders were getting heartily sick of the whole thing.

MR. LEE asked whether it would not be possible to shorten the time of the adjournment. He had been the means of inducing many people to put a considerable amount of money into the company, and he felt very strongly about the matter. If he thought it was going to be any advantage, he would support the amendment, although he had seconded the resolution, but he could not really see that they would be doing any good by passing the amendment.

MR. HARRISON said he would withdraw his amendment, subject to having a promise from the directors that the terms of the proposed reconstruction should be sent round to the shareholders at least seven days before the adjourned meeting at which it was to be considered.

The SECRETARY said that under the articles the directors would be bound to give at least eight days' notice of the meeting, because it would be in the nature of a special resolution, and subsequently if the resolution was passed at the first meeting it would have to be confirmed at another extraordinary meeting which could not be held until a period of at least 14 days had elapsed from the first meeting, or later than 28 days.

MR. MOORE stated that as far as he was concerned he did not believe the company would get any "forrader" until a committee of shareholders had been appointed to investigate the whole position.

MR. BENTLEY said he was sure that the directors would be only too delighted if the shareholders would co-operate with them in putting the company on its feet.

MR. HARRISON said that he would remind them they had not yet had a balance-sheet, which he thought they were justly entitled to ask for.

The SECRETARY said that that would cost about £400, and at present there was no money to pay for it.

Eventually it was agreed to adjourn the meeting until Monday, October 13th, due notice of the time and place to be given to all the shareholders.

Companies Struck Off the Register.—The following have been struck off the Register, and are accordingly dissolved :—

Dynelectron Syndicate.
Electrical and Mechanical Exhibition.
Electric Coin Freed Meter Dimming Syndicate.
Electric Tramways Trust.
Hirst Magneto Co.
Illuminating Engineering Co.
Morris-Hawkins.
Motor Hiring Syndicate.
Schreiber Electric Battery Co.
Vulcan Dynamo and Motor Co.

Buenos Ayres Tramways Co.—As a result of the decision of the Anglo-Argentine Tramways Co. to issue new ordinary shares to the amount £750,000 to £800,000, the proceeds of which are to be utilised for carrying out the new works already in hand, the Belgian Company of Tramways of Buenos Ayres, holding at present the whole of the ordinary share capital of the Anglo-Argentine, has resolved to issue 60,000 *bons de caisse* of 500 fr. each, bearing interest at the rate of 6 per cent., for redemption in 5 years, two-thirds of the amount to be issued immediately.

Ascot District Gas and Electricity Co., Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum (6s. per share), less income-tax on the ordinary shares for the half-year to June 30th.

Davis & Timmins, Ltd.—The directors recommend the payment of the interest on the 6 per cent. preference shares and an interim dividend on the ordinary shares at the rate of 6 per cent. per annumn for the half-year ended June 30th, 1913.

Bishop's Stortford, Harlow and Epping Gas and Electricity Co., Ltd.—The report states that, including £1,110 brought forward, the accounts for the half-year to June 30th, show an available sum of £3,704. The directors declare dividends at the full statutory rates of £5 14s. per cent. per annum and 5½ per cent. per annum on the "A" and "B" ordinary stocks respectively, carrying forward £615.

Halifax and Bermudas Cable Co., Ltd.—The directors have declared a dividend on the ordinary shares of 6s. a share, being 6 per cent. for the year.

Direct West India Cable Co., Ltd.—The directors have declared a dividend on the ordinary shares of 1s. 6d. a share, making 6 per cent. for the year.

Stewarts & Lloyds, Ltd.—The directors have declared interim dividends for the half-year ended June 30th, 1913, at the rate of 6 per cent. per annum on the preference shares, and at the rate of 10 per cent. per annum on the preferred ordinary shares, to be paid on September 26th.

Brazilian Traction, Light and Power Co. — The directors have declared a dividend of 1½ per cent. for the three months ending September 30th, 1913, on the 6 per cent. cumulative preference shares, payable in Toronto on October 1st, 1913.

South Metropolitan Electric Light and Power Co., Ltd.—The warrants for interim dividends, due the 31st inst., on the company's 7 per cent. cumulative first preference shares and 6 per cent. cumulative second preference shares, for the half-year ended June 30th, 1913, have been posted.

Aberdeen Suburban Tramways Co.—Mr. G. J. Walker, the chairman, at the half-yearly meeting moved the adoption of the report which recommended a dividend of 2½ per cent. He said the directors had had under their serious consideration the question of extending the company's operations by the working of railless cars or other mechanically-propelled vehicles, and they were satisfied that the working of such vehicles would not only be profitable in itself, but would be profitable as a means of attracting fresh traffic to the company's undertaking. Mr. F. T. Garden moved—"That the shareholders authorise and empower the directors to work trackless cars or other mechanically-propelled vehicles in connection with the company's undertaking." This was agreed to.

Stock Exchange Notice.—The Committee has appointed Thursday, September 18th, as a special settling day, and also ordered the following securities to be quoted in the Official List :—American Telephone and Telegraph Co.—$34,101,600 convertible 4½ per cent. Gold Bonds, Nos. M 1 to 15,140 and 26,501 to 43,080 of $1,000, D 1 to 1,555, 1,601 to 1,624 and 1,701 to 2,555 of $500, and 1 A to 698 C and 951 A to 1,418 C of $100 each.

German Electrical Companies.

The *Continentale Ges. für Angewandte Elektrizität* (*Applied Electricity Co.*) reports gross profits of £49,000 for 1912-13, as compared with £38,000 in 1911-12, when a dividend at the rate of 6 per cent. was declared on share capital of £120,000. In addition to factories at Landeck in the Tyrol and at Poissy, France, the company maintains works at Erith, Kent. The headquarters have been removed from Glarus to Basle.

The *Körting Elektrizitätswerke A.G., of Berlin*, whose activity is limited to the ownership and working of several supply works, which now represent a total connection of 12,189 KW., realised gross receipts of £65,000 in 1912-13, as compared with £69,000 in the previous year. After meeting general expenses and placing £18,000 to depreciation as against £20,000 in 1911-12, the accounts show a net surplus of £15,500, as in the preceding year. The dividend is at the rate of 8 per cent., being the same as in 1911-12.

The *Isaria Zählerwerke A.G., of Munich*, which company is closely associated with Brown, Boveri & Co., of Baden, earned gross profits of £101,000 in 1912-13, as contrasted with £88,000 in the preceding year. After meeting general expenses and other charges, and setting aside £6,800 for depreciation in 1912-13, as against a similar sum in 1911-12, the net profits are returned at £19,000, as compared with £15,000. The directors recommend a dividend of 10 per cent. on the share capital of £110,000, being the same rate as in the previous year. The report mentions the formation in London of the firm of Isaria, Ltd., in April, 1912, whose share capital is held entirely by the parent company, and it also states that the orders brought over into the new year show a considerable increase over the corresponding period in 1912.

The report of *Brown, Boveri & Co., of Mannheim*, for 1912-13 states that the turnover was 25 per cent. greater than in the previous year. The production, particularly in the steam turbine and electrical departments, was increased and the prime costs reduced, and it was possible to comply with the frequent requirements for early delivery. In steam turbines the company was well employed on large units, and the largest order received was for a machine of 40,000 H.P. for the Mark communal electricity works—a size which had hitherto not been used on the Continent. After referring to the work carried out by the ship turbine department, the report recalls the protracted action which was decided in favour of the Brown-Boveri group last October, and according to which electrical firms who construct turbo-generators have to obtain a licence from this group. The company received an order for the generators for the hydro-electric works building for the Prussian Government in connection with the Mohnetal dam and the Edertal dam; and the system of winding engine plant for mines found extended use. A considerable expansion took place in the railway department, and the orders included 15 main line locomotives for the Laubach-Konigszelt section of the Prussian State railways. A locomotive shop for the erection of locomotives will be brought into full operation in the autumn of 1913, and the transformer department is also being enlarged. The accounts show gross profits of £202,000 for 1912-13 as against £166,000 in the preceding year. After meeting general expenses and other charges and placing £38,000 to depreciation as compared with £27,000 in 1911-12, the net profits and balance forward are returned at £36,000 as contrasted with £21,000. It is proposed to pay a dividend of 8 per cent., this comparing with 5 per cent. and 4 per cent. in the two preceding years respectively.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Bath	Aug. 30	5,600	+1,141	35	33,962	+ 2,477	..	..
Blackpool-Fleetw'd	„ 30	10,246	+1,477	8	17,726	+ 2,650	8	..
Bristol	„ 29	38,291	+4,611	35	277,649	+32,837	30·5	..
†Brit. Elec. Trac. Co.	„ 22	119,360	+14,312	34	843,505	+69,687	..	..
Chatham and Dist.	„ 28	4,486	+ 442	34	31,527	+ 1,670	14·98	..
Cork	„ 28	2,428	+ 198	34	17,136	+ 210	9·89	..
Dublin	„ 29	25,857	+ 929	35	207,887	+ 5,427	54·25	..
Hastings	Sept. 1	7,732	+1,078	..	..	+ 2,667	19·3	..
Lancashire United	Aug. 27	6,845	+ 940	34	51,792	+ 5,428	39	..
Llandudno-Col. Bay	„ 29	3,743	+ 219	39	13,550	+ 1,195	6·5	..
London United ..	„ 29	30,631	+3,418	35	220,611	+ 1,456	..	..
Tyneside	„ 27	2,086	+ 391	9	4,823	+ 431	11	..
Anglo-Argentine ..	„ 26	213,749	+19,857	..	1,884,512	+165,451	..	..
Auckland	„ 1	18,960	+ 667	4½	22,067	+ 209	25·5	1·3
Bombay (B.E.T.) ..	„ 1	12,086	+ 948	31	96,134	+ 4,218	..	..
Brisbane	July	26,205	+ 3,145	..	177,208	+46,494	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Aug. 30	17,974	+1,175	..	..	..	..	..
Cape Electric T. Ld.	..	..	..	..	..	..	..	..
Kalgoorlie, W.A. ..	July 31	2,793	..	..	20,022	..	20·6	..
Lisbon	..	..	..	..	..	..	..	..
†Madras	Aug. 31	3,675	+ 173	35	28,780	+ 2,110	15·25	1
Montevideo ..	„ 31	23,829	+2,520	44	316,431	+26,324	..	..
Cen. London Rly.	„ 30	14,629	−2,523	35	170,198	+10,810	6·78	·4
City & S. Lon. Rly.	„ 30	9,044	−1,327	35	97,963	− 9,487	7·26	..
Dublin-Lucan Rly.	„ 29	809	+ 104	8½	1,653	+ 205	7	..
L'pool Overh'd Rly.	„ 31	7,634	+ 677	35	60,134	+ 4,784	6·6	..
London Elec. Ry. Co.	„ 30	44,065	−1,715	35	477,875	+ 3,795	21·25	..
Mersey Railway ..	„ 30	8,492	+ 284	35	77,798	+ 4,984	4·5	..
Metropolitan Rly.	„ 31	62,489	− 576	35	583,841	+ 2,603	25·75	..
Met. District Rly.	„ 30	46,210	+1,419	35	459,897	+17,926	25	..

STOCKS AND SHARES.

Tuesday Evening.

Investment business is the only kind of trade which is doing in the Stock Exchange. Speculation breaks out sporadically. One day there is animation in Americans; on the next, it is rubber shares which are affected. But there is little continuity of movement; and although August produced more business than it does as a rule, nobody connected with stocks and shares is sorry to see the new month, with its promise of better trade which the autumn is supposed to usher in. Prices, on the whole, remain firm, the strength of Consols being a useful factor. On the other hand, the Dublin riots aroused a certain amount of anxiety lest the Irish fever might spread to English workmen, occasional flickers of unrest in English circles serving as reminders that this kind of agitation is likely to remain with us as long as the poor.

The list of English Electricity Supply shares is colourless, the only actual changes being ⅛ rise in County of London Preference shares to 12⅛, and of 1 in London Electricity 4 per cent. Debenture stock, which took the price to 90½. Two or three *ex* dividend markings have produced practically no net change.

The market in Foreign issues is almost equally tame, although here there is generally a little Mexican news—either adverse or favourable—to freshen things up. This week prices are better, Mexican Light and Power Common and Preference both rising 2 points. The feature amongst Latin-Canadians is the strength of Shawinigan Water Capital shares, which have risen 5½ to 142; there are further rumours in the air with regard to a possible agreement between this Company and some other. Toronto Debenture stock came into demand, the price advancing 2 points; and for some of the other companies' bonds there is a steady investment inquiry.

Mexico Trams Common shares gained 1½, which lifted the price to 100. Brazil Tractions hardened a little, and the Anglo-Argentine Tramways group is better in places. United Electric Tramways of Monte Video shares improved to 4⅞, the high yield attracting buyers. British Columbia Electric Railways stocks came to market, and the quotations show a few small falls.

In the Home Railway department, prices have been moving in zigzag fashion. Business is erratic, and a good deal of it emanates from the professional brigade. With labour troubles in the offing, prices cannot get under way to any satisfactory extent; and whenever the wind seems set in a favourable direction, some gust blows from an unexpected quarter and twists prices down again. Districts are ¾ lower at 34¾, Metropolitans ¼ down at 48, while the Surplus Lands stock at 60 is 1 easier. The Central London "assented" trip is *ex* dividend. Great Northern and City Preferred shares remain at 2¼, unaffected by the announcement that, although the company will not be taken over by the Metropolitan until later on, for all practical purposes the fusion has already taken effect, and improvements are to be made at once in the working of the line. The talk is revived of extending the system to Lothbury, but the scheme is evidently in the air at present.

The recent sellers of London and Suburban Debenture stock finished their orders, and upon the pressure being withdrawn, the price was put up 6½ to 76½, business being marked on Monday at 77. The substantial rises in British Electric Traction stocks have made further progress, the improvements ranging from ½ to 1, on top of the gains noticed last week. South Metropolitan Debenture at 70 is 4½ up. The Underground Railways group is firm; both the Income Debenture stock and the Income bonds are now quoted *ex* their interest.

At the Marconi meeting the chairman's speech was received with somewhat mixed feelings, in consequence of the absence of much detail which would enable people to form an idea of the dividend-earning capacity of the concern. The shares accordingly weakened a trifle, but firmed up later, and the net movement leaves rises of ⅛ in the Ordinary and Preference shares. American Marconis, after being 1⅞, reacted to 1⅝; while Canadians eased off to 11s. 9d. after having been about 6d. higher. Speculative interest in the Marconi market will probably drop for a bit, there being nothing exciting to "go for," so far as can be seen, in the immediate future. But the shares have furnished sufficient surprises in the past to make the observer extremely reticent about venturing upon excursions into the land of Marconi prophecy.

The Telegraph market, as a whole, is quietly steady, and the announcement of further reductions in rates by some of the leading cable companies has had no appreciable effect upon quotations, although the step is hailed with satisfaction by those who have noticed how previous experience in the same direction has turned almost invariably to the advantage of the companies concerned. Mackay Common at 86½ is 3½ higher, in response to New York buying. Cuba Telegraph Preference have weakened.

The feature in the manufacturing group is the strength of British Aluminium shares and British Westinghouse Preference. In the last-named there is now a market almost active, as compared with the utter stagnation into which the shares had fallen for many months previously. British Aluminium Preference are ⅛ higher, and the company's two Debenture issues have both hardened. Brush 4½ per cent. Debenture stock, quoted *ex* dividend, stands now about 38. The Rubber Share market pursued an erratic path, early strength in the shares being sapped by rumours that a large quantity of raw rubber will be offered for sale at the Mincing Lane auctions next week. There is not much public business doing in the shares.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Sept. 2nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5½	6	9¼ — 10¼	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	9¼ — 9¾	..	4 14 9
Do. Second 6 % Pref. ..	10	6	6	9⅞ — 10⅜	..	5 15 8
Do. 4½ % Deb. Stock	Stock	4½	4½	98 — 98	..	4 11 10
Brompton & Kensington, Ord. ..	5	10	10	8¾ — 8¾	..	5 14 3
Do. 7 % Cum. Pref.	5	7	7	8⅝ — 8⅝	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4⅜ — 4⅞	..	5 2 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 17 3
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4	..	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4⅜ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	8	9	14½ — 15½ xd	..	5 14 8
Do. 6 % Cum. Pref.	10	6	6	11½ — 12½ xd	..	4 14 1
Do. 5 % Deb.	Stock	5	5	114 —118	..	4 4 9
Do. 4½ % Second Deb. ..	100	4½	4½	99 —101	..	4 9 1
County of London, Ord. ..	10	6	6	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	11¼ — 12⅜	+ ⅛	4 17 6
Do. 4½ % Deb.	Stock	4½	4½	102½ —104½	..	4 6 2
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	Nil	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	6	4 — 4⅜	..	3 8 7
Do. 6% Non-Cum. Pref. ..	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	88 — 90	..	5 0 0
Hove	5	9	9†	7⅞ — 8⅛	..	5 9 1

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Sept. 2nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Kensington & Knightsbridge, Ord	5	9	8†	7⅛ — 7⅞	..	5 16 0
Do. 4 % Deb.	Stock	4	4	88 — 91	..	4 7 11
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	74 — 78	..	5 15 5
London Electric, Ord.	3	2½	2½	1⅛ — 1⅜	..	4 7 9
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛ xd	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	89 — 92	+1	4 7 0
Metropolitan	5	4	4†	8¼ — 8⅝ xd	..	5 10 4
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	5 0 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 99	..	4 10 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	77 — 80	..	4 7 6
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅛ — 10⅛	..	5 14 3
Oxford	5	7½	6†	6 — 6½	..	5 11 6
St. James' and Pall Mall, Ord.	5	10	10†	8¾ — 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6¾ — 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	85½ — 85½	..	4 1 10
South London, Ord.	4	5	5½	2¾ — 3⅛	..	7 0 9
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref. ..	1	7	7	1 3/32 — 1 5/32 xd	..	6 1 3
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 10 6
Urban, Ord.	£3	Nil	Nil	⅛ — ⅜	..	..
Do. 5 % Cum. Pref.	5	2	3	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	85 — 88	..	5 2 3
Westminster, Ord.	5	10	10	8½ — 8¾	+ ⅛	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5⅛	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	4⅞ — 5⅛ xd	..	5 17 1
Calcutta, Ord.	5	8½	8½	7 — 7⅛	..	5 18 4
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛ xd	..	4 17 6
Calgary Power, 1st Mort. Bds.	100	5	5	90½ — 92½	..	5 8 1
Canadian Gen. El. Com.	$100	7	7	113 —117	..	5 19 8
Do. 7 % Pref.	$100	7	7	119 —124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	3	5	3/8 — 1/2	..	6 3 1
Do. 5 % Deb.	100	5	5	93½ — 95½	..	5 4 9
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	6	6	90 — 92	..	6 10 5
Elec. Supply Victoria, 6 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	90 — 92 xd	..	5 8 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	6	5/8 — 11/16	..	10 18 4
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	+1	4 16 2
Madras, Ord.	5	Nil	..	1½ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 —106	..	4 14 4
Mexican El. Lt., 6 % 1st M. Bds.	..	5	5	78 — 82	..	6 1 11
Mexican Lt. & Power, Common	$100	4	4†	66 — 70	+2	5 14 4
Do. 7 % Cum. Pref.	$100	7	7	97 —102	+2	6 17 3
Do. 5 % 1st Mort. Gold Bds.	..	5	5	90 — 92	..	5 8 8
Do. 5 % 2nd Mort. Bonds ..	100	5	5	79 — 81	..	6 3 5

Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	74 — 77	..	6 9 10
Montreal, Lt., H. and Power ..	$100	8	9†	215 —225	..	4 0 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	10	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 8
Shawinigan Water, Capital ..	$100	5	5½	140 —144	+5½	3 16 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105 —107	+ ⅛	4 13 6
Do. 4½ % Per. Deb.	Stock	4½	4½	99½ —102½	..	4 7 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99½ —101½	+2	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90¼ — 92½	..	5 8 1
Victoria Falls Power, Pref. ..	1	11½d.	17½d.	1/8 — 1/8	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105 xd	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	94 — 96	..	5 2 2
American Telep. & Teleg., Cap.	$100	8	8	182 —185	..	5 18 6
Do. Collat. Trust	$1000	4	4	90 — 92	..	4 7 0
Anglo-American Telegraph ..	Stock	3	3	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	6	6	107½—108½	— ⅜	5 10 10
Do. Def.	Do.	80/-	80/-	23½ — 23¾	..	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	103 —104 xd	..	4 16 2
Chili Telephone	5	7	8	7 5/8 — 7 3/4	..	5 5 10
Commercial Cable, Stg. 4% Deb.	Stock	4	4	82 — 84	— ½	4 15 3
Cuba Telegraph	10	6	6	8½ — 9½	..	6 9 9
Do. 10 % Pref.	10	10	10	15½ — 16½	— ½	6 3 1
Direct Spanish Telegraph, Ord.	5	4	4†	8½ — 8¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6¾ — 7¼	..	6 18 0
Direct United States Cable ..	10	5	4	6⅞ — 7⅛	— ⅛	5 12 3
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	127 —130	..	5 7 8
Do. 8½ % Pref. Stock	Do.	8½	8½	75 — 77	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	96 — 97	+ ½	4 2 6
Eastern Extension	10	7	7	12½ — 13	..	5 7 8
Do. 4 % Deb.	Stock	4	4	92 — 94	..	4 5 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	95	4	4	99 —101	..	3 19 8
Globe Telegraph and Trust ..	10	6	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12⅛ — 12⅝	..	4 15 1
Great Northern Telegraph ..	10	18	20	30 — 32	..	6 13 0
Indo-European Telegraph ..	25	13	13	55¼ — 57½	..	5 13 1
Mackay Companies Common ..	$100	5	5	85 — 88	+3½	5 13 8
Do. 4 % Cum. Pref.	$100	4	4	66 — 70	..	5 14 4
Marconi's Wireless Telegraph	1	10	20	4 — 4½	+ ⅛	4 17 0
Do. 7½ % Cum. Partic. Pref.	1	17	17	3 5/16 — 3 11/16 xd	+ ⅛	4 18 11

Monte Video Telephone, Ord. ..	1	6	6†	3¼ — 1 3/16	—1/16	5 9 8
Do. 5 % Pref.	1	5	5	3/4 — 1	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 —101	+ ½	4 9 1
Oriental Telep. and Elec. ..	1	8	10	13 3/32 — 13 7/32	..	5 8 6
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	— ½	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98	..	4 1 8
Reuter's	10	10	10	9¾ — 10½	..	9 37 6
Submarine Cables Trust	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 9
United River Plate Telephone	5	8	8†	6½ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 — 5½	..	4 11 0
West Coast of America	2½	2½	..	1 3/16 — 1 7/16	..	4 3 4
Do. 4 % Debs., 1 to 500 guar. by Braz. Sub. Tel.	100	4	4	98 — 96	..	4 1 8
West India and Panama Teleg.	10	1½	1½	2¾ — 2¾	..	4 6 11
Do. 6 % Cum. 1st Pref. ..	10	6	6	9¾ — 10½	..	5 18 5
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9¼ — 9¾	..	6 1 6
Do. 5 % Debs.	100	5	5	99 —101	..	4 19 0
Western Telegraph, Ltd. ..	10	7	7†	12¾ — 13¼	..	5 5 8
Do. 4 % Deb.	Stock	4	4	90½ — 92½	..	4 6 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	92 — 95	..	4 14 9

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 3s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Sept. 2nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	* 1	Nil	Nil	¾ — ⅞	..	Nil
Do. 5 % Pref.	1	5	5	6 8 — 6 12	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 5 % Pref. ..	100	..	..	10 — 10½	+ ½	..
Do. Do. Deferred ..	100	..	..	4½ — 6	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	86 — 89	+1	6 14 10
Do. 7 % Non-Cum. Pr'f.	100	..	3	47 — 50	+1	6 0 0
Do. 5 % Perp. Deb. ..	100	5	5	91 — 94	+1	5 6 5
Do. 4½ % 2nd Deb. ..	100	4½	4½	75 — 78	+ ½	5 15 5
Central London Railway, Ord.	100	3	3	73 — 75	..	4 0 0
Do. Gtd. Assented	100	..	..	80 — 82 xd	+1	4 17 7
Do. Pref.	100	4	4	77 — 79	+1	5 1 3
Do. Gtd. Assented	100	..	..	81 — 83 xd	..	4 16 3
Do. Def.	100	2	2	75 — 77	..	2 12 0
Do. Gtd. Assented	100	..	..	79 — 81 xd	+1	4 18 9
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	98 —100	..	5 0 0
Do. Do. 1896	100	5	5	98 —100	..	5 0 0
Do. Do. 1901	100	5	5	97 — 99	..	5 1 0
Do. Do. 1908	100	5	5	97 — 99	..	5 1 9
Do. 4 % Deb.	100	4	4	93 — 95	+1	4 4 3
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2⅛ — 2⅜	..	Nil
Hastings Trams, 6 % Pref. ..	1	6	6†	⅞ — 1⅛	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	68 — 73	..	6 3 3
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅛ — 2⅜	..	4 15 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	76 — 78	..	6 8 2
London and Suburban, Ord. ..	1	..	..	⅛ — ⅜	..	..
Do. Do. 5 % Cum. Pref.	1	..	..	1/16 — 1/8	..	..
Do. Do. 4½ % 1st. Deb.	100	..	4½	74 — 79	+6½	5 13 11

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Sept. 2nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
London Elec. Railw'ys, 4 % Deb.	100	4	4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	60 — 64	..	6 5 0
Metropolitan Railway Consol. ..	100	1⅞	1⅝	47⅜ — 48½	— ½	3 7 4
Do. Surplus Lands	100	2⅜	2⅜	59 — 61	..	4 10 2
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	81 — 83	..	4 4 4
Do. 3½ % Con. Pref.	100	3½	3½	77 — 79	..	4 8 7
Metropolitan District Ord. ..	100	Nil	Nil	34¼ — 35	— ⅜	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	82 — 84	..	5 7 2
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 86	..	5 2 3
Do. 5 % Deb.	100	5	5	90 — 93	..	5 7 6
Potteries, Ord.	1	3½	3½	⅜ — ⅝	..	..
Do. 5 % Pref.	1	5	5	1/16 — 1/8	+ 1/32	7 5 6
Do. 4½ % Deb.	100	4	4½	82 — 85	..	5 6 5
South Metro. Trams, 6 % Pref.	1	..	..	⅝ — ¾	..	8 0 0
Do. 4 % Deb.	100	..	4	68 — 72	+ 4½	5 11 1
Underground Elec. Railways	10	..	..	3⅞ — 4⅛	..	Nil
Do. "A"	1/-	4½	..	6 — 6	..	Nil
Do. 6% First Cum. Inc. Deb.	100	1⅛	6	109 —111 xd	..	5 8 1
Do. 4½ % Bonds	100	Nil	4½	99 —101	..	4 9 1
Do. 6 % Income	100	3	6 †	91½ — 92½ xd	..	6 7 9
Yorkshire (West Riding), Ord.	5	..	..	⅛ — ¼	..	Nil
Do. 6 % Pref.	5	..	3†	8⅛ — 8½	— ⅛	..
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4⅛ — 4⅜	..	5 11 4
Do. 2nd Pref.	5	5½	5½	4⅜ — 4⅝	..	5 18 11
Do. 4 % Deb.	100	4	4	91½ — 93½	+ ½	4 5 7
Do. 4½ % Deb.	100	4½	4½	95½ — 97½	..	4 12 4
Do. 5 % Deb.	100	5	5	98 —100	+ ½	5 0 0
Auckland Trams, 5 % Deb. ..	100	5	5	100 —102	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅝ — 11⅛	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	95½ — 96½	+ ½	6 4 4
risbane Trams Invt., Ord. ..	5	8	8	7 — 7⅞	..	5 6 8
Do. 5 % Pref.	5	5	5	4⅜ — 5⅛	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	98 —101	+1	4 9 —
B. Columbia Elec. Rly., Def. ..	100	8	8†	125 —130	—1	6 3 3
Do. Pref. Ord.	100	6	6	111 —116	..	5 3 5
Do. 5 % Pref.	100	5	5	102 —105	— ½	4 15 8
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb. ..	100	4½	4½	100 —102	..	4 8 8
Do. 4½ % Con. Deb.	100	4½	4½	95 — 97	— ½	4 7 8
Calcutta Trams, Ord.	5	7	5†	5⅜ — 6⅛	..	5 12 0
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	96 — 99	+ ½	4 11 0
Cape Electric Trams	1	2½	5	1/16 — 1/8	..	6 3 1
City Buenos Aires Trams (1904)	5	5	5†	5⅛ — 5⅜	..	4 9 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	1/16 — 1/8	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	6	3	26 — 36	..	..

La Plata Elec. Trms, Ord. ..	1	Nil	..	⅛ — ⅜	..	..
Do. Pref.	1	6	..	1⅝ — 1⅞	..	5 16 6
Lisbon Elec. Trams, Ord. ..	1	6	6	1⅛ — 1⅜	..	4 9 8
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	5	..	6	4⅜ — 5⅛	..	5 17 1
,, Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb. ..	100	5	5	87 — 89	..	5 12 4
Manila Elec. R. and Ltg., Bonds	$1000	5	5	97 — 99	..	5 1 0
Mexico Trams Com.	$100	7	7†	98½ —100½	+1½	6 19 4
Do. Gen. Con. 5 % Bonds ..	..	5	5	89 — 91 xd	—1	5 9 11
Do. 6 % Bonds	100	6	6	92 — 94	— ½	6 7 8
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	6 — 6⅛ xd	..	7 13 10
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛ xd	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	98½ —100½	..	4 19 6
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5½	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100		4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..		5	101 —103	..	4 17 1
Do. 5 % Mort. Bonds	100	5	5	95 — 97	..	5 3 1
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	102 — 104	..	4 16 2
Singapore Trams, 5 % Deb. ..	100	5	5	85 — 89	..	5 12 4
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video ..	5	7	7	4⅜ — 5⅛	+ ⅛	6 16 7
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 18 7
Do. 5 % 1st Deb.	100	5	5	97 —100	..	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	101 —103	..	4 7 5

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	⅞ — 1⅛	..	7 7 8
Do. 6 % Pref.	1	6	6	1⅞ — 2⅛	..	7 2 6
Babcock & Wilcox	1	28	16	3⅛ — 3⅜	..	5 0 5
Do. Pref.	1	6	6	1⅛ — 1⅛	+ 1/16	4 3 6
British Aluminium, Ord. ..	1	Nil	..	1/16 — 1/16	..	..
Do. 6 % Cum. Pref.	1	Nil	6	1/16 — 1/16	+ 1/16	6 8 0
Do. 5 % Prior Lien Debs. ..	100	5	5	92 — 95	+1	5 5 3
Do. Deb. Stk.	100	5	5	83 — 86	+1	5 16 3
B.I. & Helsby Cables	5	10	10	7⅜ — 8⅛	..	6 1 3
Do. Pref.	5	6	6	5⅜ — 6⅛	..	4 16 0
Do. Deb.	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	92⅜ — 95⅜ xd	..	4 14 0
British Westinghouse, Pref. ..	8	Nil	Nil	1⅛ — 1⅜	..	Nil
Do. Deb.	100	4	4	60 — 62	+1	5 15 11
Do. 6 % Prior Lien	100	6	6	101 —104	+1	5 15 5
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb	100	4½	4½	85⅜ — 40⅜ xd	..	11 2 2
Do. 4½ % Second Deb. ..	100	4½	4½	28 — 27	..	16 13 4
Callender's Cable	5	15	15	10⅞ — 11⅛	..	6 10 5
Do. Pref.	5	5	5	4⅛ — 5⅛	..	4 18 9
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	20	8⅛ — 8⅛	..	5 4 11
Do. Deb.	100	4½	4½	102 —105	..	4 5 9

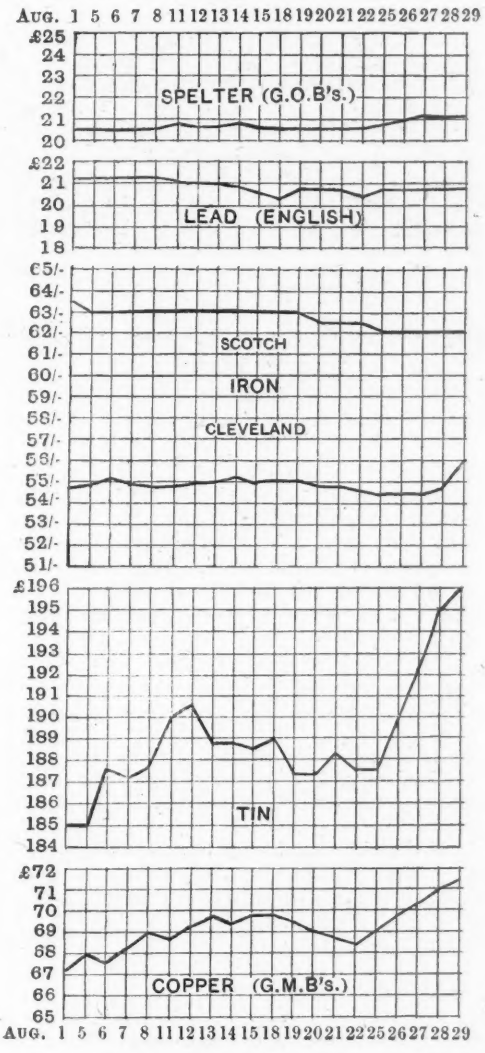
Crompton & Co., Deb.	100	5	5	54½ — 59½	..	8 8 0
Dick, Kerr	1	5	Nil	⅝ — ¾	..	..
Do. Pref.	1	6	6	1⅝ — 1⅞	..	7 13 10
Edison & Swan, A, £8 paid ..	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1½ — 1⅞	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	3½	5	1 — 1½	..	8 0 0
Do. Pref.	2	7	7	1⅛ — 2⅛	..	6 15 9
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, 6% Pref. ..	10	5	6	9½ — 10½	..	5 14 3
Do. Deb.	100	4	4	89 — 94	..	4 5 1
Henley's, Ord.	5	15	15	12½ — 13 xd	..	5 15 5
Do. Pref.	5	4½	4½	4⅛ — 5⅛ xd	..	4 8 11
Do. Deb.	100	4½	4½	100 —102	..	4 8 3
India-Rubber, G. & T.	10	..	7½	12⅜ — 13⅜	..	5 9 1
Do. Pref.	10	5	5	9⅜ — 10⅜	..	4 18 9
Telegraph Construction	12	17½	20	37 — 39	..	6 3 1
Do. Deb.	100	4	4	95 — 97	..	4 2 6
Willans & Robinson	1	Nil	..	⅛ — ⅜	..	Nil
Do. Pref.	5	Nil	..	¼ — ½	..	Nil
Do. Deb.	100	4	4	55 — 57	..	7 0 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4½ per cent., April 17th, 1913.

METAL MARKET.

Fluctuations in August.



A New Rubber Plant.—The Mexican Department of Agriculture announces a fresh source of rubber supply, viz., the red *Plumeria* or *Cacaloxochilt*, as the plant is called by natives. All the known Mexican members of this family have a milky sap, but the red plumeria is the only one yielding caoutchouc in sufficient quantities to make its collection worth while. The stem of the tree is 6 to 15 ft. in height, and 8 to 24 in. in circumference; the bark is thick and bright grey in colour. The tree is widely distributed over Mexico and Central America, and favours a sandy or rocky soil, altitudes between 1,000 and 5,000 ft., and dry localities where the annual rainfall averages from 27 to 45 in. Propagation is effected by cuttings, and tapping may be commenced when trees are three years old. Since the young wood contains most caoutchouc, the latter is collected, not by tapping the bark, but by pruning the young shoots and recovering the sap from the pieces cut away. The life of the tree is not curtailed by this treatment. On the other hand, if pruning be performed judiciously, the number of young shoots can be multiplied almost indefinitely. The twigs and shoots removed contain about 4 per cent. of a caoutchouc comparing very favourably with the grades now on the market, and having the following analysis: Resin, 21·9 per cent.; water, 15·07 per cent.; caoutchouc, 25·5 per cent.—*Elek. Anzeiger.*

Country House Lighting Plants.—In the new extension of the works at Northfield, near Birmingham, of the Austin Motor-Car Co., Ltd., now nearing completion, a separate department is being established for the manufacture of stationary petrol motors, principally intended for country house electric lighting installations. The Austin Co. proposes to devote its attention particularly to engines which work in conjunction with the Walker-Horrocks automatic system. Special attention is to be given to a small plant, entirely automatic in its working and suitable for installations up to 50 lights.

ELECTRICITY SUPPLY IN DOVER.

(*Concluded from page* 330.)

Distributing Systems: Cables, &c.—D.C. supply at 500 volts for traction and large motor demands is distributed from the switchboard alongside the battery room, while 2,000-volt single-phase distribution for lighting and small power consumers is effected from a 1903-type Ferranti board. The traction output is metered on the switchboard, and is delivered to the tramways department at the Town Hall, at which point the interest of the station in the matter ceases: current is thence distributed to various switching pillars in the tramway area under the control of the tramways department.

Twenty-two open-type Gilbert arcs are installed along the Folkestone Road in two series circuits (alternate lamps on each circuit); these lamps are supplied from the traction bus-bars, and are switched off from the station at midnight, reduced illumination being then provided till dawn by incandescent lamps on the tramway poles.

The only feature calling for special notice in the A.C. switchboard is the stepped coils through which the A.C. street lighting circuits are closed; flame arcs in the two main streets of the town and the metallic-filament lanterns on the sea front are thus controlled.

The original concentric rubber-insulated H.T. mains laid in iron pipes are still in use, but faults are now becoming fairly frequent; the electrostatic stresses caused by the central control of the street lighting circuits are severe, notwithstanding the use of switching chokers. Paper-insulated, lead-sheathed L.T. mains are laid in iron pipes and paper-insulated, lead-covered, armoured power mains are laid direct. The total lengths of various classes of cable now in use are:—H.T. rubber-insulated and paper, lead-covered, 17 miles; L.T. paper, lead-sheathed, and power lead-covered armoured feeders and distributors, including L.T. services, 32 miles.

There are 27 underground transformer stations now in use, in addition to local transformers on piers, the clock-tower and so on. The largest sub-stations had originally three 18-KW. Brush transformers, but, with the exception of one Burnand and two Westinghouse transformers, Berry apparatus is now used, and one 50-KW. and one 18-KW. unit form the equipment of the main sub-station.

The original Brush arcs along the front were adapted to the use of flame carbons in March, 1906, and were replaced by H.C.P. Harrison lanterns, in combination with the arc lamp hoods, containing four 100-C.P. tungsten lamps, in April 1912, when also the open-type A.C. arcs in the main streets were replaced by flame arcs. Each lamp standard was originally equipped with a 2,000/50 V., 750-W. transformer, and on installing metal lamps, it was found economical to fit 50/100-V. auto-transformers (costing 15s. each). The high iron losses involved by the double transformation are comparatively unimportant, as the street lighting circuit is open during the day. It is estimated that £300 per annum is saved by the metal filament installation as compared with the old Brush lamps, together with the substitution of "flame" for open arcs in the main streets. Extensive conversions from gas to electric street lighting have recently been effected, and, including those proposed for the current year, will result in a saving of nearly £1,500 per annum. A further annual saving of £200 will be effected by the installation of 325 time switches for street lamp control.

Loads Supplied.—The distribution of the total sales for this and last year is shown in Table III. The number of consumers is approximately 1,350. The introduction of the metallic-filament lamp led to a serious diminution in the lighting sales during 1907 and necessitated an increase of ½d. per unit in the lighting tariff in 1909. Fortunately the crisis has now passed and, as the mean revenue per unit sold is steadily increasing (from 3·62d. in 1907 to 4·51d. in 1911 and 4·02d. in 1912), while the costs per unit sold are diminishing (see Table II), it is probable that a reduction in the lighting tariff will soon be possible. Four cinematograph halls are supplied; three operate on A.C., through local transformers, while the fourth employs a motor converter set to allow of the exhibition of Kinemacolor films (which require a D.C. arc of

TABLE III.—Distribution of Output.

	1912-1913 (estimate).		1911-1912.	
Public lamps—Arc		100,000		109,410
" " Incandescent		25,000		25,493
Tramways*		437,000		436,916
Admiralty lighting	55,000		32,700	
" power	40,000		23,000	
Duke of York's School	39,000		39,000	
Messrs. Pearson's lighting	21,000		31,000	
" " power	20,000		52,000	
Harbour Board†	15,000		15,000	
Private consumers (by meter)		738,000		712,421
		1,300,000		1,284,240

* Seven miles track, 4·75 miles route (1·25 miles sleeper construction), 21 double-deck cars each with two 25-H.P. motors and seating 44 passengers; 303,406 car-miles; 2,767,889 passengers in 1911-1912. † Including cranes on Admiralty Pier, four capstans on Prince of Wales Pier and swing bridge over Wellington Dock.

very high candle-power to suit the very short exposure of each picture and to allow for absorption in the colour screens).

For many years past it has been the practice to illuminate the promenade with festoons of coloured lamps. From 1,000 to 1,500 5-C.P. and 8-C.P. carbon lamps have been employed, and a very light and cheap overhead construction has been possible, since any moisture collecting in the lamp sockets, &c., was rapidly boiled out without any electrolytic damage such as would occur on D.C. supply. Unfortunately, this scheme was abandoned last year, much to the disappointment of visitors. The cheapness and beauty of the illuminations certainly made them a good investment as regards the popularity and welfare of the town.

The chief lighting and power consumers are shown in Table III. During the building of the Harbour works, Messrs. Pearson's took very large quantities of energy for lighting and power; but this demand has recently decreased, and will soon cease entirely; it has, indeed, been extended longer than was anticipated by the contract for the widening of the Admiralty Pier, which work is now nearing completion. The increasing Admiralty demand compensates to a large extent for the loss of the contractor's load, and at present consists in a lighting demand on the E. and W. Arms and S. Breakwater (which are served by a ring main, enabling supply to be given from either end), and a power demand for various crane and other D.C. 500-volt motors.

Messrs. Pearson's have been supplied for lighting at flat rate, and for power at 4d. after dark and 1½d. per unit during the day—to correspond with the 24-hour flat rate of 2½d. per unit charged to the tramways. The Admiralty have already been supplied for over three years, and it is expected that a 10-year contract for bulk supply (probably about 400,000 units per annum) will be made in the near future. Dover is to be made an important submarine station, and it is expected that the demand for charging the submarine batteries will reach about 250 KW., and that the annual consumption will be in the neighbourhood of 240,000 units.

A useful miscellaneous power load of press motors, gutta-percha strippers, &c., is supplied, but the single-phase supply which is used for small motors does not favour a rapid increase in their use. Typical winter and summer load curves are shown in fig. 1, from which it will be seen that the turbine or Ferranti set alone can supply the usual evening peak. During 1911-12 the maximum demand was exceptional, owing to the Coronation festivities, and was 521 KW. A.C. (normal 424 KW.), and 495 KW. D.C. (normal 363 KW.). The load factor is good for this class of station, and is likely to be increased considerably by future Admiralty day loads. The actual load factors in 1911-12 were 15·93 per cent. A.C., 12·86 per cent. D.C., 14·43 per cent. combined, but the maximum demand during this period was exceptional on the A.C. mains, owing to the Coronation illuminations, and on the D.C. mains owing to the official trials of reducer sets installed by the Admiralty for charging submarine batteries. Excluding these exceptional demands, the load factors in 1911-12 were 19·57 per cent. A.C., 17·53 per cent. D.C., 18·63 per cent. combined. The power factor of the A.C. supply is 90 per cent., and no measures are required for its improvement.

The financial success of the undertaking is handicapped by the heavy capital burden (over £102 per KW.) which results in high annual capital charges (1·48d. for interest, 0·80d. for sinking fund; total, 2·28d. per unit in 1912-13), and prevents such additional outlay as would undoubtedly increase the economy and scope of operation of the undertaking. Thanks to a most careful administration, the financial position of the station has steadily improved during recent years, and as compared with a gross profit of 5·43 per cent., and a net deficit of £3,171 in 1908-9, there was realised 7·93 per cent. gross profit, and £3,254 net surplus in 1911-12, leaving an outstanding deficit on net revenue account of £1,370. In 1912-13 the gross profit realised was 6·78 per cent. and the surplus £1,092.

In conclusion, our best thanks are due to Mr. L. W. Woodman, M.I.E.E., borough electrical engineer, for his courteous assistance in the compilation of the above notes.

ADVERTISEMENTS AND THE LAW OF DEFAMATION.

[BY A LEGAL CONTRIBUTOR.]

The advertiser who is at a loss for words in which to extol his own wares is sometimes tempted to depreciate those of a rival trader. It need not be done directly. Many subtle devices may be adopted in order to show that the wares of Brown, Jones or Robinson will not bear comparison with those of Smith. For instance, a table might be published showing that, under similar conditions, "Smith's 20th-century Excelsior lamp outshone those of all other competitors." It might then be stated that taking the efficiency of Smith's lamp as 100, that of Brown's lamp was 75, that of Jones's 50, while poor Robinson's lamp only reached 25!

Persons who were sufficiently simple to accept Smith's own untested figures might be led to avoid the lamps sold by the other three gentlemen, who would suffer damage in consequence.

This method of attaining publicity and others still more subtle may sometimes be adopted by persons who are not in the habit of playing cricket in the commercial sense. But do they do more than offend against certain unwritten laws which are generally observed by good men of business? Are they, in other words, within reach of the law of libel?

It is an elementary principle of the law of libel that a "thing" cannot be libelled. To write (*e.g.*) that a motor-generator is badly designed or constructed is not actionable *per se*; whereas to write of an electrical engineer that he is a bad designer of generators could clearly be made the subject of a claim for libel, although the plaintiff was unable to show that any actual damage had been occasioned to him.

The law cannot be better summarised than in the words of Mr. Spencer Bower, K.C., who has recently published "A Code of the Law of Defamation." He writes:—

Disparagement of property is actionable at the suit of any person entitled to the property so disparaged, though such disparagement is not such as to amount to or involve defamation if, but not unless, such person alleges and proves the several facts in clause (2) hereof mentioned, provided that: (1) For the purposes of this article, "property" means and includes every species of property known to the law, whether real or personal, corporeal or incorporeal, and in the case of goods, it includes not only specific goods but any type or class or kind of article manufactured, sold, or otherwise dealt with in the course of any person's trade or business; (2) Disparagement means and includes any publication of matter, the meaning or effect of which is to deny or cast doubts upon the existence or validity of any person's right, claim, title or interest to or in any property, or to depreciate or disparage the merits, utility, qualities, or value of any person's property; but the mere assertion by any person that any manufacture or invention of his own or any class of goods in which he deals, or other like property, is superior to that of all other persons, or of any particular person, does not of itself constitute the disparagement.

(3) In order to maintain an action for disparagement of property, it is necessary and sufficient to allege and prove

each and every of the following facts, that is to say (1) that the defendant has published matter in disparagement of the plaintiff's property ; (2) The such matter is false ; (3) The such publication was actuated by malice as in the next clause defined ; and (4) that the plaintiff has sustained actual damage, which was either the natural and probable result of publication, or the result which the defendant had, in fact, intended. "Malice" means any motive other than that of asserting, protecting, promoting, or defending, any claim, interest, or duty, either of the person who has published the disparaging matter, or of some person whom in virtue of privity of estate or agency he is entitled to represent, or to, or in, or with, reference to the property disparaged in the existence and validity of which claim he believed when publishing the matter.

It will be seen that the plaintiff who founds an action on disparagement of goods has a somewhat onerous duty to discharge. He must prove that the words were false and malicious, and that he has suffered actual damage. For instance, to revert to the case of the lamps quoted at the commencement of this article, Robinson could not hope to succeed in an action against Smith for saying his lamps had but 25 per cent. of the efficiency of Smith's lamps, unless he could prove that he was actually damaged by the statement, and that it was false and malicious.

He would have to bring one witness to Court to say : "I have made tests, and Smith's tests are untrue and misleading." He would also require another witness to say : "I was on the point of trying Robinson's lamp, when I suddenly saw this advertisement, and bought Smith's (or Brown's) instead." The question of malice would, of course, be for the jury to determine, but if the statement was *true*, it would not matter that it was malicious. For Smith to say *truly*, in his advertisement : "My boosters are infinitely more efficient than Brown's" cannot be libellous, although the jury find that Smith is actuated by malice, and not by a fair and proper motive.

From what has been said it will be seen that the type of advertisement which depends upon "odious comparison" cannot often be questioned on the ground of illegality. At the same time, we should be very sorry to see this objectionable method of self-laudation, even in relation to goods, come into greater vogue than it is in at present.

THE PEKING LEGATION MACHINERY.

We have received from the British Engineers' Association the following correspondence, to which we refer in our leading columns :—

Sir,—In order to remove a serious misapprehension which is damaging British engineering interests in China, the British Engineers' Association has obtained the authorisation of H.M. Office of Works to publish a letter addressed by that Department to this Association, dated March 7th, 1913, and a schedule containing the names of certain contractors which accompanied it. Copies of these are attached to this letter.

These documents have to do with a contract for an electrical and refrigerating installation recently erected at the British Legation in Peking. The conditions surrounding the invitations to tender, and the placing of this contract, have led to a very general belief that the machinery was manufactured in Germany. The false impression to the effect that the official centre of British interests in China had been equipped with German machinery has proved a severe blow to British engineering prestige. The Chinese are continually told, by the representatives of certain Continental firms, that the British Government were obliged to go to Germany because there were no makers in England capable of doing the work satisfactorily.

The enclosed documents show that there is no foundation whatever for this statement. This Association would, therefore, deem it a favour if you would give publicity to the letter from the Office of Works above referred to, and to the following facts :—

1. The contract was not given to the Siemens China Electrical Engineering Co., a purely German concern representing the Siemens German interests, but was placed with the Siemens Bros. Dynamo Works, Ltd., in London. Whether this firm is considered British or not, it possesses works in Great Britain.

2. Messrs. Siemens only manufactured a portion of the plant in question, and this, according to the enclosed letter, was manufactured not in Germany but in England.

3. The rest of the plant was also manufactured in Great Britain by the British firms whose names are given in the schedule attached, some of whom are members of this Association.

The following causes gave colour to the misconception that the machines were German :—

(*a*) Until now no official denial has been published.

(*b*) The erection of the plant at the Peking Legation was entrusted to a German firm in China, the Siemens China Co., and this company were assumed by many to be the contractors owing to a similarity between their name and that of the contractors.

(*c*) The public generally have either been unaware that there was a stipulation that the whole of the plant must be made in Great Britain, or have believed that such a stipulation was not enforced.

This Association is aware that the manner in which this contract was negotiated and placed has caused grave dissatisfaction among the purely British firms who originally tendered. On this question, however, I am not directed to enter. The point which this Association is anxious to make clear is that, on the authority of H.M. Office of Works, the whole of the plant installed at the British Legation in Peking was manufactured in Great Britain.

I am, Sir, your obedient servant,

Stafford Ransome.

Secretary of the British Engineers' Association.

Caxton House, S.W., *August 28th*, 1913.

Letter from His Majesty's Office of Works, dated March 7th, 1913, to the Secretary of the British Engineers' Association.

Sir,—With reference to your letters of the *12th inst.* and *22nd ult.*, I am directed to furnish the following information respecting the contract for engineering works at the British Legation at Peking.

1. Tenders were originally invited in August, 1911, from British firms only, and before an invitation was issued to the firm whose tender was ultimately accepted, they were required to satisfy both the board's officer in Peking and the British Consul that they might be so regarded.

2. Owing to the conditions prevailing in China in December, 1911, the board decided not to proceed with the work, and the firms who tendered were informed accordingly. No undertaking was given, however, that fresh tenders would be called for at a subsequent date.

3. When it was found possible to proceed with the work, time did not permit of the invitation of fresh tenders, but the two firms who had submitted the lowest tenders in the first instance were asked to submit fresh prices. The more favourable tender, that of Messrs. Siemens Brothers Dynamo Works, Ltd., was then accepted.

4. The whole of the plant has been manufactured in England. A schedule is attached showing the names of the sub-contractors by whom the various parts of the work have been undertaken.

5. The erection of the plant is being carried out by the contractor's representatives, the Siemens China Electrical Engineering Co., under the supervision of a British engineer, by whom Chinese labour is being employed direct.

I am, Sir, your obedient servant,

(Signed) Lionel Earle.

The Secretary,
British Engineers' Association,
Caxton House, Westminster, S.W.

British Legation, Peking.

Main contractors for the above contract—Siemens Bros. Dynamo Works, Ltd.

The following is a list of the contractors and the material they are supplying :—

Specification A.—This covers :—(1) Steam heating installation ; (2) Hot and cold water supply installation.

1.—Steam Heating.

Contractor.	*Material.*
Babcock & Wilcox.	Main boilers and fittings, Weir's feed pump, pipework in boiler house and engine rooms.
Atmospheric Steam Heating Co.	Complete steam heating installation in the various buildings, including pipework, feed-water heater, vacuum pumps, radiators, valves, fittings and accessories.

2.—Hot and Cold Water Installation.

Rees Roturbo Mfg. Co.	1,000-gallon pumps.
Siemens Bros. Dynamo Works, Ltd.	Motors for above pumps.
Whipp & Bourne.	Starting gear for above motors.
Fredk. Braby & Co.	Tanks, cisterns and cylinders.
Hartley Sugden, Ltd.	Dome top boilers.
Stewarts & Lloyds.	Valves and lap-welded tubes and accessories.
T. & W. Farmiloe, Ltd.	Lead piping, paint, &c.
Merryweather & Sons, Ltd.	Fire hydrants.
Thos. Piggott & Co., Ltd.	12 × 12 × 8-ft. pressed-steel tank.

Specification B.—This covers :—(1) The electrical generating plant ; (2) ice-making plant.

1.—Electrical Generating Plant.

Contractor.	*Material.*
Siemens Bros. Dynamo Works, Ltd.	Main generators, main switchboard, main cables, motor-booster set, wiring material for engine and boiler rooms, electrical fittings and accessories.
Belliss & Morcom, Ltd.	Main engines.
Pritchetts & Gold.	Battery.

2.—Ice-Making Plant.

Siemens Bros. Dynamo Works, Ltd.	Motor for driving ice-making plant.
Mr. Sam. Puplett.	Ice-making plant.

REVIEWS.

Practical Alternating Currents and Alternating-Current Testing. By C. F. Smith. Manchester: Scientific Publishing Co. Price 6s. net.

This is undoubtedly one of the best books on alternating currents that we have seen. Very little fault can be found either with the method of treatment or the subject matter of the book, for the treatment is clear and thorough, and the subject matter has been carefully chosen and prepared.

The book is written upon experimental lines, but the principles are not neglected, and in no case does the author depend upon any "rule-of-thumb" methods where first principles can be used to provide an explanation.

Mr. Smith has made full use of graphical methods and vector diagrams for circuits with both capacity and self-induction, and the early chapters on Impedance, Power Factor and Capacity would be hard to beat for clearness.

Actual results of experiments are given in many cases, and curves plotted from the results given. This is a far better way of dealing with alternating currents than the usual method of drawing diagrams for a general case and leaving the reader to guess at the magnitudes of the actual currents, speeds, and resistances from which the curve would have to be drawn in practice.

The section on transformers is very complete, and the line diagrams are well drawn. The method of obtaining the equivalent resistance and the discussion of the general effect of the secondary on the primary are also well stated.

The chapters on Alternators and Synchronous and Induction Motors are essentially experimental. The explanation of the rotating magnetic field is not up to the author's usual standard of lucidity, and we may also reasonably complain of finding no comparison made between the capabilities and performances of the two kinds of A.C. motors. It is also doubtful whether the last chapter, on Wave Composition and Analysis by means of Oscillographs and Fourier Series, will appeal to the type of reader that Mr. Smith is obviously catering for in his earlier pages; but apart from this, the last chapter must be regarded as one of the best in the book.

Mr. Smith's book will undoubtedly prove of use to students in technical colleges in connection with their laboratory work, and will also appeal to a wider range of readers on account of the exceptionally logical and lucid method of treatment.

Reports of the Committee on Electrical Standards Appointed by the British Association for the Advancement of Science. 1913. Cambridge: University Press. Price 12s. 6d. net.

The original British Association Committee on Standards of Electrical Resistance was appointed in 1861 at the suggestion of Prof. William Thomson (later Lord Kelvin), and, to quote Lord Rayleigh's prefatory remarks, the early reports of this Committee were for many years the highest authority on their subject. The 39 reports up to 1912 have now been republished under the editorship of Mr. F. E. Smith, whose intimate acquaintance with recent developments of the subject, in which he has taken a leading part, eminently qualifies him for the task. This publication has been made possible by a generous donation of £100 from Mr. R. K. Gray, and by a similar grant from the General Committee of the Association.

At the time of the appointment of the Committee, "no coherent system of units for the measurement of electric resistance, current, electromotive force, quantity or capacity had met with general approval," and the principal object of the Committee was, first, to determine what would be the most convenient *unit* of resistance, and second, what would be the best form and material for the *Standard* representing that unit.

It is difficult to appreciate fully the gigantic task before this Committee, and it is certainly impossible to overestimate the value of its work in bringing order out of chaos, and in fixing the standards by which all our electrical measurements are now made. Some idea of the chaos upon which this Committee was called to brood may be gained from the fact that the word Ohm was then uncoined, and the units of resistance were based on the more or less arbitrary size and weight of some conductor in the form of a wire. The units in England, for example, were (1) the resistance of a foot of copper wire weighing 100 grains, and (2) the resistance of 1 mile of copper wire $\frac{1}{10}$ in. in diameter.

On the other hand, the activities of the Committee between 1862 and 1870 may be gauged from the following list of reports:—

1. The measurement of a resistance in terms of the centimetre and second, by Prof. J. Clerk Maxwell and Messrs. Balfour Stewart and Fleeming Jenkin.
2. A determination of the dynamical equivalent of heat from the thermal effects of electric currents, by Dr. Joule.
3. An investigation of resistance alloys, by Dr. Matthiessen.
4. The determination of a unit of capacity, by Dr. Matthiessen, Prof. Carey Foster and Mr. F. Jenkin.
5. The determination of "v," the ratio between the electrostatic and electromagnetic units, by Sir Wm. Thomson, and also by Prof. J. Clerk Maxwell.

When it is pointed out that all these reports in their entirety, illustrated with drawings of the original apparatus, and often couched in the very words of these master scientists, are printed in the first 290 pages of this book, it is obviously unnecessary to comment further on the unique value which this republication must have, both from a purely scientific and from a practical standpoint.

During this early period Sir William Thomson had been making his memorable investigations into electrostatic measurements, and had designed the various electrometers that now bear his name. The fifth appendix to the Dundee report (1867) is a "Report on Electrometers and Electrostatic Measurements," by Sir William Thomson, F.R.S., and contains 35 pages, a complete illustrated account of repulsion electrometers, symmetrical electrometers and attracted-disk electrometers, together with a general statement of the theory and practice of the replenisher.

There are no doubt many people who would be roused to enthusiasm by the announcement of a text-book of electricity by J. Clerk Maxwell—and there is truly much excuse for enthusiasm over Appendix B to the 1863 Report, for here we have reprinted a 60-page treatise "On the Elementary Relations Between Electrical Measurements," by Prof. J. Clerk Maxwell. This appendix in itself is of immense value, and will, no doubt, be read with eagerness by those to whom these reports have hitherto been inaccessible.

In 1870 the Committee was "unable to report any material progress," and suggestions were made for the appointment of several small committees. These committees devoted themselves to consideration of (1) the standard of resistance; (2) the standard of capacity; (3) the standard of electromotive force; and the reports immediately following are chiefly concerned with the testing of various coils and the establishment of national standard laboratories.

Although the work of the Committee since that time has not been of such an epoch-making kind, it has, nevertheless, been of great scientific importance. In 1891 it prepared evidence for the Board of Trade inquiry into the "Standards for the measurement of electricity for use in trade," and it has taken an active part in the preparation of the specifications for the Clark cell, and other more recent forms of standard cells.

Considerable space in the later reports is devoted to the consideration of resistance thermometry, and the Committee authorised various comparisons and researches to be made on electrical and gas thermometry, the results of which are embodied in appendixes to the reports in 1893, 1899 and 1903.

In 1895 the Committee turned its attention to magnetic units, and discussed a paper on this subject by Dr. Oliver Lodge. This paper is printed in full in an appendix to the report, and is a valuable, though little known, contribution to the literature of magnetism. The 1896 meeting devoted its time to discussing a standard heat unit; suggestive letters from the highest authorities on heat measurement were received, and these are duly published with the report in this volume.

The Electrical Standards Committee is to be congratulated

on this publication of the labours of its members and their illustrious predecessors, not only on account of its historical interest, but as providing an excellent statement of principles by such masters as Kelvin and Maxwell, and also as pointing out the lines of recent research and progress in electrical measurement.—P. H. S. K.

Resuscitation. By C. A. Lauffer, M.D. London: Chapman & Hall. Price 2s. net.

This is a small book by the medical director of the Westinghouse Electric and Manufacturing Co., of Pittsburg. It describes simply and concisely Schäfer's prone pressure method of artificial respiration, which should be tried in all cases of electric or traumatic shock, drowning or asphyxiation from any cause; the directions for self-instruction are supplemented by anatomical details, so that an intelligent grasp of the rationale of the treatment may be obtained by those who read the book.

Dr. Lauffer was struck by the number of cases that came under his observation where the respiratory apparatus had become temporarily inhibited and death had supervened before medical aid could be procured. Had those present at the accident possessed the simple knowledge of producing artificial respiration, many of these lives could have been saved.

Accordingly he set to work to train as many men as possible within his sphere of influence, and one man alone of those was instrumental in saving six victims of electric shock—all of which would have been fatal cases but for his timely and efficient efforts.

As was pointed out in these pages a few months ago (April 4th), death may be instantaneous as the result of a shock, the heart being thrown into a state of fibrillary contractions. It would be impossible for a layman to differentiate between such a case and one where respiratory inhibition only had occurred, so that all victims of shock should be at least given a chance of being brought round even though the labour entailed should be wasted.

The same method is applicable to cases of apparent drowning, inhalation of noxious gases, various poisons, shock produced by heavy blows, &c.

Wechselstromarbeitsdiagramme: Das Rechnen mit umlaufende Vectoren nach der Symbolischen Methode. By Emil Waltz. Berlin: Hermann Meusser. Price M. 22.5.

Herr Waltz, in his preface, states that he originally merely intended to produce a German translation of Messrs. Cramp and Smith's book on "Vectors and Vector Diagrams," but decided later that a complete survey of the subject would involve the writing of practically a new and much enlarged book, and this plan he finally adopted. The result is a volume about three times as large as the English book, although covering, if anything, rather less ground.

The extra space is devoted, in typically German fashion, to a more thorough and detailed study of the points touched upon.

Whether this will help the ordinary student, is an open question, as the extreme detail evidently aimed at is often the cause of much waste of time to the reader. It also makes it difficult for him to get a clear view of the relative importance of the various quantities, since many of the points raised are minor ones, of purely theoretical interest.

Numerical examples are fairly frequent, but even these often have an air of unreality for want of diagrams of connections and arrangement, and a clearer explanation of the relations of the given resistances, reactances, &c., to the dimensions of the apparatus dealt with.

As a comprehensive reference book on the subject of vector and circle diagrams as applied to simple alternating circuits, to transformers and to induction motors (other apparatus have had to be excluded for amount of space), the volume will, however, prove of considerable value to those already having a good working knowledge of alternating currents.

The explanation of the actions going on in the polyphase induction motor, given in Chap. 12, is especially clear and to the point.

WORKSHOP FLOORING.

By W. H. Booth.

The flooring of a workshop is a detail deserving of considerably greater attention than it often receives. A floor should be something more than a mere division between two rooms, though this view of a floor has been in the past carried to such an extreme, that it has often not been thought necessary to make a floor sufficiently sound to prevent dust from falling through the cracks and upon the tools beneath. With this view of the duties of a floor, it is not surprising that the ground floor, below which there is no room, should be left of plain unvarnished dirt. We say unvarnished advisedly, because a dirt floor that is varnished is better than one that is unvarnished. The usual dirt floor appears to be cinders trampled hard, and, in process of time, more or less covered with iron dust. When dry such floors are very dusty and cause a deposit of dust upon the machine tools, greatly to the detriment of these costly appliances. To prevent dust, especially when sweeping up, it is the practice to water such floors, a proceeding which promotes the rusting of the iron filings, and probably, when the water has evaporated, leaves the floor dustier than ever. But, except with an undesirable amount of swilling, a dirt floor will always cast up much dust when swept.

If anyone is so unfortunate as to possess a dirt floor, he may mitigate its faults by means of oil. An oiled floor will be dustless. The oil should be a heavy non-volatile quality of petroleum residuum, so as to be free from inflammable vapour, and it should be sprinkled hot through as fine a rose as it will freely pass. The application should be scanty, and repeated if necessary after the effect has been observed. No more than necessary must be employed. After the first application, all collection of dirt about machine feet should be removed with a sharp flat spade, and the whole floor should be kept level, and no low places allowed to wear in it. Such a floor ought to be swept with a softish brush, and damp sawdust may be sprinkled all over before sweeping. Men working at machines should stand on boards to keep them off the floor. The worst dirt producer in a shop is the badly cleaned casting, which brings in sand and black dirt. Castings properly cleaned by acid water, and washed off, bring in no dirt.

One of the worst floors is that of soft pine, which splinters badly and cannot be kept nicely clean. For heavy shop floors the street paving block of hard wood is a good covering. To make a good floor with blocks which shall be even, the foundation of concrete must first be laid and floated level to a fine surface, which should first be allowed to set to dryness, and then hot tarred. The floor blocks may then be laid on it, each block being dipped in hot tar mixture as laid, and tapped up to the adjacent blocks and down on its bed.

Such a floor is expensive. It is probable, however, that the blocks need not exceed 3 in. in height, for the wear of a shop floor is small compared with that of street paving.

Such a block floor would be put into good condition by dressing with linseed oil. All floors in the best American shops are made of ⅞-in. maple boards about 4 in. wide, nailed across pine boards about 1½ to 2 in. thick, these being in turn nailed to battens that are sunk level in concrete. The pine boards thus rest on the concrete.

In an English modification of this floor the concrete is of breeze floated over with tar mixture, upon which are nailed pine boards, and on these again the hard maple. There is no doubt that no floor exceeds the maple floor in excellence for light tool shops. It is lightly oiled with linseed to keep it in order and kept swept, and where dirt tends to trample hard on it, scraped. Such floors, properly attended to, remain clean, smooth, and free from dust.

The pine floor is of too open a grain to remain dust free. If the colour is not objected to, the Australian woods of the eucalyptus order would probably serve well as floorboards if well seasoned and dried, for they are hard and close grained. Except the Jarrah, of West Australia, and its congener the Karri, the Australian timbers are not much seen here. The blue gum, tallow wood, and blackbutt are familiar timbers in Australian wagon works, are dense and heavy, and should make good flooring wood, if laid dry enough not to curl edgeways in the process of further drying.

Where machines are run flooded in lard oil, there are rarely provided floor trays of an area sufficient to catch all the oil drops or greasy shavings of metal. Such trays ought to be much larger than usually provided. Automatics are so usually placed together that it would seem good policy to stand them on an entirely metal-sheeted floor in a section by themselves.

Where a machine requires a special foundation and holding-down bolts, there is no objection to this being at the general level of the concrete, the pine and facing timber coming between this and the machine, and any holding-down bolts standing through the timber. But where a special foundation comes up through the floor, the boards should come close up to the foundation, and the joint should be concealed by laying round the foundation block and upon the floor a fillet of wood 2½ in. × 1½ in. or thereabouts as a finish.

Except in these special cases floors should always extend completely beneath machines, which can then be removed and their positions varied without inconvenience. Most machine tools can be placed direct upon a good floor, and to this end machines ought to be planed on the underside of their bed-plates parallel with the top side. A level floor will then give level machines with least cost in erection. A floor should, in fact, be such that a properly-made machine need only be simply set down upon it to be ready to run, coach screws being a sufficient holding-down. When a machine is

removed the screw holes in the floor ought to be plugged with plugs of the same material cut with the grain horizontal and planed off after driving nearly flush.

The objects to be kept in view in planning a floor are level surface upon which and about which machines may be placed and moved at will; a surface to which dirt will not adhere and in which chips will not become imbedded; a surface easily to be cleaned and which will not break up into splinters. It should be free from knots, and this alone will bar all the cheap pines of the northern hemisphere. It should be easy to sweep, close jointed, so that, if necessary, it can be washed without letting water percolate, and it should be capable of a sufficiently oily surface to adhere to dust until the sweeper comes round.

Though pine wood can be had free from knots, such timber is too soft and absorbent of oil, water and chips; the pitch pine may be excepted. The pines of Australia and New Zealand are hard, closely grained and dense timbers of less splintering nature and remarkably free from knots.

Where, as at the entrance of a room, a floor wears into a hole, this should be prevented by closely studding it with small hard nails over the part where wear takes place, or a grid of plain bars may be let into the floor like a mat, removable, so that the accumulation of dirt can be cleared away.

Generally, the floor of a shop ought not to be looked upon as the dumping ground for rubbish and tea leaves, and there should be nothing upon the floor, except what is necessary for the work in hand, such as castings or forgings too heavy or bulky to be placed on shelves or benches. No benches other than solid-fronted benches with drawers, should be placed against the walls of a shop, otherwise rubbish will surely accumulate in the covered space. Shelving for tools, small parts, &c., should be open to light on both sides, and most shelving would be better made of wire netting or of expanded metal than of wood or of sheet metal. For tools such as have cutting edges the shelving and shop stands should, of course, be of hard wood; but even then a shelf of narrow-spaced bars will prevent accumulation of dirt from taking place. Asphalt or any semi-plastic material is of doubtful value, as heavy articles gradually sink into it, especially in warm weather, and the hollows thus formed become receptacles for dirt.

THE KEOKUK POWER DEVELOPMENT.

One has become so accustomed to regard the United States as the home of big things, that the Keokuk hydro-electric development on the Mississipi River, despite its projected capacity of 300,000 H.P., is apt to be overlooked.

Actually it is the largest water-power plant in the world, and that, moreover, with a comparatively low head of water.

Our American contemporary, *Power*, recently described at considerable length many interesting features of this scheme, and the following particulars are gathered from this source.

Naturally the constructional work concerned the civil engineer rather than the electrical man, as it was necessary to hold up the Mississipi River, which at Keokuk is nearly a mile in width, and divert a large proportion of its flow, ranging from 20,000 cb. ft. per sec. minimum to 372,000 cb. ft. per sec. maximum through thirty 18 ft. diameter concrete tubes to the turbines in the power house, which stands in the river.

For about 12 miles above this point the river level falls some 23 ft. over the Des Moines Rapids, and the erection of the dam has had the effect of forming a lake from one to three miles wide, for 65 miles above the dam, with a depth at its lower end of 40 ft. and at its upper end of 8 ft. One of the conditions imposed by the United States Government was that navigation should not be interrupted, and thus it comes about that a lock and a large dry dock were incorporated with the dam, which take the place of a now disused 9-mile canal, which formerly passed round part of the rapids.

The dam itself has a total length of 4,649 ft., and consists of 118 concrete piers 6 ft. wide, 53 ft. high, and with a thickness of 29 ft. at the top and 42 ft. at the bottom, the taper being on the down stream face.

The intervening 30 ft. spaces between the piers were subsequently filled by means of a concrete web rising 32 ft. above the river bottom, with vertical up-stream and curved down-stream faces.

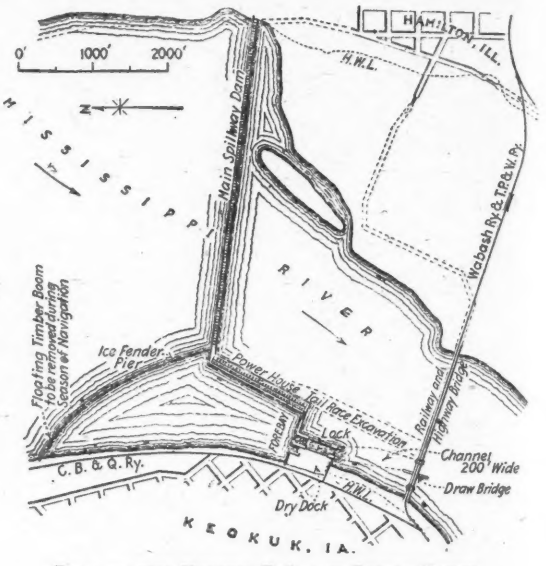
The webs are surmounted by adjustable steel gates which hold back the water and create a difference in level of between 29 ft. and 41 ft. depending on their position.

The dam is of the gravity type and coffer-dams were used in its construction, the river being only some 7 ft. deep.

The first 36 spans of the east end of the dam were built on a meadow intervening between the normal shore of the river and the bluffs, and for these no coffer-dam was needed. Coming to the river, a sectional coffer-dam 78 ft. wide was constructed, as required, the first section to be put down being about 1,000 ft. long. Subsequent sections ranged in length from 400 ft. up. A complete pumping plant containing two 6-in. centrifugal pumps of about 1,000 gallons per min. capacity, was used for pumping out the various sections of coffer-dam enclosed area.

The first operation in constructing the dam was to blast out a slot in the rock bottom of the river several feet deep and as wide as the base of the dam itself in which the solid concrete work of the huge monolithic structure was commenced. Thus, the dam was firmly keyed in position. Next, the solid concrete piers and overhead connecting arches were poured into steel moulds. As a section of the concrete hardened, the forms were removed and used again. A partition wall was thrown across the coffer-dam between the finished and unfinished work and the section of coffer-dam thus rendered unnecessary would be destroyed. Coffer-dam material was economised and the least possible obstruction was made to the flow of the river, the spaces between the piers being left clear for the water to flow through.

On the site of the power-house, dry dock and lock a large coffer-dam was put down and pumped out, unwatering an area of

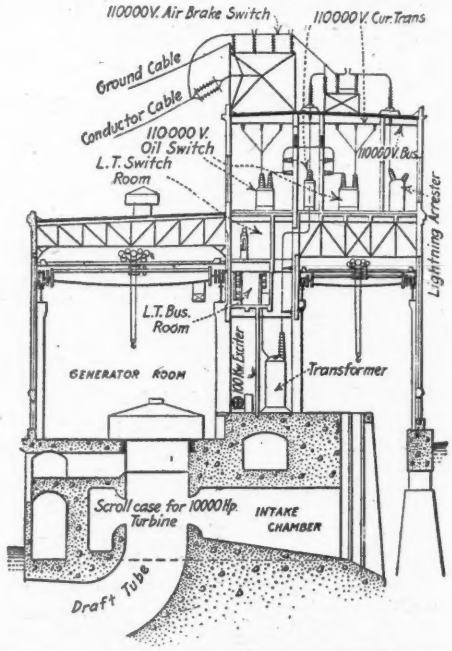


Plan of the Keokuk Dam and Power House.

35 acres. After the completion of these structures the work of building up the dam between the piers was commenced.

The power house will ultimately be one-third of a mile long; the first section built is 859 ft. long, and as in the case of the dam, &c., is of concrete, but partly reinforced on the walls, with a width of 133 ft., and depth, including the part under water, of 177 ft.

The substructure portion containing the intake tubes, turbines, and draft tubes, is 70 ft. high from the bottom of the foundations, which are 25 ft. below the river bed, and rest on solid limestone. The sectional view gives some idea of the arrangement of the



Sectional View of the Keokuk Power House.

generator and switch rooms, while a further sectional view shows the arrangement of one of the generating units.

The present equipment consists of 15 Francis type turbines, normally rated at 10,000 H.P., but capable of giving 13,000 H.P. each, which are claimed to have an efficiency of 86 per cent. on a 32-ft. head, and speed of 58 R.P.M.

The turbine runner, 16 ft. in diameter, carries 20 blades, and is hung on a 25-in. shaft, which carries the alternator rotor at its upper end, and is supported half way in a single huge thrust bearing, the weight of the revolving parts being some 550,000 lb.

Two steady bearings are also provided to hold the parts in position.

The thrust bearing is of the roller type, and is provided with means for forcing a film of oil between the two faces at 250 lb. per sq. in. pressure, to float the load and obviate the need of rollers. An attempt is to be made to operate with the rollers only, and use oil in emergencies. The turbines are fitted with Lombard governors, and four water-inlet passages are provided to each runner, each fitted with a headgate and screen.

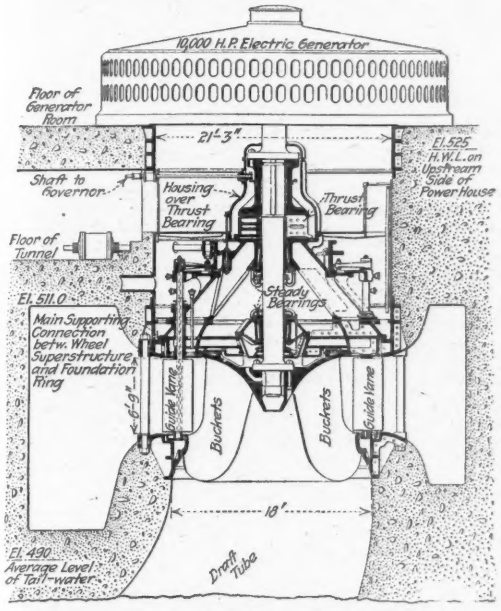
The alternators are each of 7,500 KW. normal output, of the revolving field type, generating 25-cycle three-phase current at 11,000 volts pressure.

Owing to their low speed these machines are 31 ft. in diameter and over 7 ft. high.

The efficiency of these generators is 96·3 per cent. at full load and their regulation is 13 per cent. at 100 per cent. power factor. Each machine is fitted with a brake to facilitate bringing the revolving parts to rest when shutting down.

The method of excitation is somewhat unusual. Two 2,000-K.V.A. alternators driven by water turbines of the same general design as the main turbines will furnish excitation current for the 30 main generators in the completed station. These feed 25-cycle current at 440 volts to three-phase bus-bars running the length of the station. From these bus-bars a 100-KW. motor-generator set is operated for each main generator, supplying it with current at 250 volts.

For emergency, another 440-volt bus has been installed for each group of 15 units, supplied from the main power bus-bars through



ARRANGEMENT OF KEOKUK HYDRO-ELECTRIC UNIT.

two 600-K.V.A. transformers and all of the motor-generators are arranged for connection with this bus. The voltage of each main generator is controlled by a Tirrill regulator connected with the field of the exciter.

Energy is distributed in the locality at 11,000 volts pressure, but for long-distance transmission it is stepped up to 110,000 volts.

High and low-tension bus-bars in duplicate are provided, coupled through selector switches to the various apparatus. One L.T. emergency bus runs the length of the station; the other, for normal use, is in sections coupled through switches and current-limiting reactances, so that each outgoing line will be fed from its own machine and transformer group. Local 11,000-volt bus-bars are also provided.

Except those for the low-tension bus sections, all switches are non-automatic, and arranged so that trouble in one section causes the opening of the two nearest section switches, and through a relay on the voltage regulators, a reduction of the generator voltage.

The emergency and transfer high-tension bus is divided into sections, one for each line. The other is simflarly arranged, but equipped with section switches, so that, if desired, the sections may be paralleled.

The low-tension switches are directly above the bus-bars, and are enclosed in concrete cells.

The low-tension circuits are guarded from internal voltage surges by electrolytic static dischargers connected to the various sections. Protection from excessive current is secured by the sectionalisation previously mentioned, which divides the equipment into 10 groups. Connection between these groups is made through current reactances rated at 240 K.V.A. These reactances consist of copper cable wound on three large concrete cores, making a total weight of about 27,000 lb.

The transformers are for three-phase, 25-cycle, 11,000-110,000-volt service and rated at 9,000 K.V.A. On the low-tension side they are connected delta and on the high-tension, star, with the neutral dead grounded. Each transformer is set in a concrete compartment and weighs 231,000 lb., and 10,000 gallons of oil is required.

The connections from the transformers to the high-tension bus-bars and switches, which consist of 1¼-in. standard iron pipe, extend vertically to the top floor where the bus-bars and switches are located. These connection pipes are painted copper colour for psychological reasons.

The high-tension switches are triple-pole solenoid operated and of 400 amp. capacity. They are provided with disconnecting switches on one side only, being attached directly to the high-tension bus-bars on the other.

The high-tension bus-bars are installed individually in separate rooms and run the full length of the building. These bus-bars are of 2-in. standard iron pipe hung from the ceiling by seven-unit suspension insulators. The connections from the bus-bars to the current transformers are of 1¼-in. copper pipe. From the transformers the connections pass directly up through the roof bushings, through choke coils to an air-disconnecting switch of the rotary double-break type, mounted 24 ft. between phases and with arms 12 ft. long. Taps to the lightning-arrester horns are made between the choke coils and the disconnecting switches. The horns are connected through roof bushings with electrolytic arrester tanks enclosed in concrete compartments on the top floor of the building.

The oil switches are all operated from a remote control bench board, which will extend round three sides of a room on the top floor; the board will be in charge of a load dispatcher who will be in telephonic communication with the entire system.

Two long-distance lines carried on a single set of towers have been run to St. Louis, 144 miles distant, where 60,000 H.P. has been contracted for. These lines are of 36,000-KW. capacity each. Two 27,000-KW. lines have also been built to Burlington.

The larger lines, those to St. Louis, are of ⅝-in. copper cable; these cables are carried on towers averaging 80 ft. high, spaced on 800-ft. centres, by means of suspension-type insulators, each consisting of seven 10-in. disks.

The Lightning Conductors of St. Paul's Cathedral.

—St. Paul's Cathedral was completed long before the introduction of lightning conductors, and it was not until 1769 that the Dean and Chapter, alarmed by serious damage to other buildings by lightning, applied to the Royal Society for advice as to the best means of safeguarding the Cathedral. Benjamin Franklin, the inventor of the lightning conductor, was, at the time, in London, and the Society invited him to act, in conjunction with Dr. Watson and Messrs. Delaval, Canton & Wilson, in advising as to the best means to adopt. This Committee disagreed as to whether points or balls should be used as terminals, and a controversy was started that lasted some years, but Franklin's recommendation of points was adopted by the Dean and Chapter, and the system for which he was largely responsible was installed.

In this scheme the metals used in the construction of the building were used as part of the system, the breaks in continuity being made up with iron bars. It is probable that, under the conditions then existing, this was sufficiently effective, but in 1872 it was found to be in bad order, owing to rust and derangement, and a system of copper ropes was installed, the mains to earth being carried through the air ducts or shafts arranged by Sir Christopher Wren in the walls for the rain-water pipes, and ending in a large sewer that almost surrounds the Cathedral.

In 1900 the conductors were overhauled, and more copper ropes were carried over the roofs and down the ducts. Recently Mr. Alfred Hands, M.I.E.E., was instructed to examine the system and advise as to the better protection of the building. He found that 21-rope conductors were carried down in the ducts, some terminating in the ground with comparatively small copper plates, others connected to iron tubes driven into the ground, and some "earthed" on to water mains; but three had been cut away and were coiled up inside the Cathedral, and others were found in the dirt in the sewer, now disused and comparatively dry.

The carrying of the conductors through the ducts may originally have been justifiable, but as from time to time gas and water service pipes, hot-water pipes, electric light leads, and other ramifications of metal were also carried into these ducts, close to the conductors and leading to various parts of the Cathedral, the arrangement was regarded as a very undesirable one, and they have all been removed by Messrs. J. W. Gray & Son, of 91, Leadenhall Street, E.C. (in which firm Mr. Hands is a partner), who have now installed 14 new main conductors of copper tape 1 in. × ⅛ in., which are carried down to earth on the outer walls, and end underground with copper plates 4 ft. × 3 ft. 6 in., sunk over 12 ft. in wet clay, with connections to hydrant mains. Connections have also been made to various roof metals not previously connected, but the copper rope conductors on the upper part of the building have not as yet been renewed. These are so interconnected that satisfactory tests are impossible, but Messrs. Gray & Son are now regilding the cross and other parts of the Cathedral, and Mr. Hands is taking advantage of the opportunity to inspect the upper part of the conductor system.

In one of the western towers a part of one of the original iron-bar conductors, erected under Franklin's supervision about 140 years ago, was found still in place. It had probably been left because of the difficulty of removing all but the lower portion, and being inside the tower, and not exposed to the weather, was still in a good state of preservation.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,692. "Electromagnet stage drop-curtain." T. B. Boatwright. August 18th.

18,727. "Spark-plugs." M. G. Kopf. (Convention date, November 8th, 1912, United States.) August 18th. (Complete)

18,728. "Spark-plug socket for oil and gas engines." E. C. Male. August 18th. (Complete.)

18,733. "Electric pocket lamps." B. Lax. August 18th. (Complete.)

18,751. "Setting any apparatus from a distance." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges., Germany.) (Addition to 30,292/10.) August 18th. (Complete.)

18,753. "Sparking-plugs." Soc. Generale des Huiles et Fournitures Industrielles L. Oleo. (Convention date, June 6th, 1913, France.) August 18th. (Complete.)

18,755. "Insulators." A. Orinschnig. (Convention date, May 5th, 1913, Austria.) August 18th. (Complete.)

48,765. "Oscillatory electrodynamic apparatus for submarine signalling and other purposes." R. A. Fessenden. (Convention date, January 29th, 1913, United States.) August 18th. (Complete.)

18,779. "Terminals and high-tension wires of magnetos for internal-combustion engines." W. Douglas (trading as Douglas Bros.). August 19th.

18,818. "Apparatus for industrially producing hydrogen and oxygen from water by electrolysis." Soc. Anon. l'Oxhydrique Francaise. (Convention date, September 21st, 1912, France.) August 19th. (Complete.)

18,819. "Electrically-propelled road vehicles." E. Cross. August 19th. (Complete.)

18,827. "Apparatus for measuring ionisation of gases." Siemens Bros. and Co., Ltd. (Siemens & Halske Akt. Ges., Germany.) August 19th. (Complete.)

18,833. "Method of and means for effecting the efficient transmission of electric signalling impulses through insulated cables and wires." A. Williams. August 19th.

18,869. "Electrolytic devices suitable for use as, or in the construction of, meters, switches, and other apparatus." W. B. Thorpe and Thorpe Meter Syndicate, Ltd. August 19th.

18,883. "Field magnets." A. Rolfe. August 20th.

18,900. "Detachable desk for use with a table telephone or other suitable support." J. D. Joyce and H. C. Lumb. August 20th. (Complete.)

18,902. "Antiseptic paper cover for the mouthpiece of telephone-transmitting instruments." H. Smith. August 20th.

18,907. "Dynamo-electric machinery and conductors therefor." Siemens Bros. Dynamo Works, Ltd., and E. O. Kieffer. August 20th.

18,924. "Sparking-plugs with an insulator composed of two parts." Siemens & Halske Akt. Ges. August 20th. (Convention date, October 25th, 1912, Germany.) (Complete.)

18,926. "Incandescent body for electric lamps, stoves, and the like." E. Podszus. (Convention date, August 21st, 1912, Germany.) August 20th. (Complete.)

18,961. "Electro-magnetic relays for use in connection with wireless telegraphy installations and for other purposes." A. B. Williams and W. A. Solomon. August 21st.

18,962. "Spark-gaps for use in connection with wireless telegraphy installations." A. B. Williams and W. A. Solomon. August 21st.

18,975. "Electrical high-tension indicator." J. Stephenson. August 21st. (Complete.)

18,983. "Safety burglar alarm." I. Shenker. August 21st.

18,997. "Portable searchlights." E. C. R. Marks. (Siemens-Schuckert Werke G.m.b.H., Germany.) August 21st. (Complete.)

19,011. "Electric batteries." A. H. Byng. August 21st.

19,017. "Trans-oceanic and long-distance telephone systems." A. J. Gaskell. (E. Gaskell, Canada.) August 21st.

19,022. "Distribution systems for vapour-electric devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 21st.

19,029. "Preventing excess voltages." F. A. Becker. (Divided application on 12,908, June 1st, 1912.) August 21st. (Complete.)

19,041. "Electric ceiling roses and the like." J. Davies. August 22nd.

19,085. "Boxes for electrical contacts." J. Bonham. August 22nd.

19,104. "Fusible cut-outs." O. L. Peard. August 22nd.

19,109. "Plates for electrical or secondary batteries or accumulators." E. Hancock and D. David. August 22nd.

19,110. "Apparatus for the display of announcements, advertisements, and the like." A. E. Turnham. August 22nd.

19,121. "Telegraphic receivers and relays therefor, and for analogous purposes." Eastern Telegraph Co., Ltd., and A. Fraser. August 22nd.

19,124. "Relinking mechanism for use in printing telegraphs or the like." Western Electric Co., Ltd. (Western Electric Co., United States.) (Divided application on 25,382/12. November 5th.) August 22nd. (Complete.)

19,125. "Telegraphy." F. G. Creed and Creed, Bille & Co., Ltd. August 22nd.

19,141. "Switch-actuating apparatus of electrically-driven machines." A. Prior and Butterworth & Dickinson, Ltd. August 23rd.

19,162. "Compasses for ships or the like." Anschutz & Co. (Addition to 19,224/10.) (Convention date, September 17th, 1912.) August 23rd. (Complete.)

19,182. "Phase-transformation of electric currents." British Electric Transformer Co., Ltd., and R. Crosbie-Hill. August 23rd.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Gear for Automatically Reversing Electric Motors Employed for Driving Machines and the Like. J. P. Hall. 10,599. May 4th.

Brush Holders of Dynamo-electric Machines and other Electric Machinery. W. White, P. Dawson and R. H. Houghton. 18,145. August 7th.

Electric Switching Devices for High-tension Alternating-current Conductors or Systems. F. Coates and A. Reyrolle & Co. 18,210. August 7th.

Fire-alarm Signal Boxes for Automatic Telephone Systems. A. J. Boult. (Denic General Electric Co.) 18,262. August 8th.

Means for Driving Dynamos Attached to Vehicles. C. E. Pehrsson. 18,482. August 12th.

Apparatus for the Measurement of Electrical Energy. H. Gottschalk and H. Aron Elektricitätszahlerfabrik Ges. 18,809. August 16th.

Production of Magnetic or Electric Fields Applicable for Changing the Frequency of Alternating Currents and for other Purposes. M. Plohl. 18,893. August 17th. (August 18th, 1911. Addition to No. 15,774 of 1912.)

Apparatus for Winding Conducting Wires for Electric Blasting Fuses into Skeins. W. E. Lake. (Fabrik Elektrischer Zunder Ges.) 20,560. September 9th.

Appliance for Holding and Supporting Telephone Receivers and Combined Receivers and Transmitters. A. H. Tullett. 20,671. September 10th. (Convention date not granted.)

Trolley Pulleys of Electric Tramcars and the Like. E. Warren and J. E. Mort. 22,696. October 5th.

Trolley Arms Used in Electric Tramcars, Telphers and the Like. Robert Dempster & Sons, Ltd., and J. W. Broadhead. 24,263. October 24th.

Incandescent Electric Lamps. F. Harrison and F. L. Harrison. 24,571. October 26th.

Engine Starting and Lighting System for Motor Vehicles. J. B. Entz. 25,386. November 5th. (March 11th, 1912.)

Method of, and Apparatus for, Annealing Magnetic Material. British Thomson-Houston Co. (General Electric Co.) 25,902. November 11th.

Electrical Switches. W. A. Knapton. 27,854. December 3rd.

Speed-governors for Internal-combustion and other Engines Driving Motor Vehicles. P. M. Justice. (North-East Electric Co.) 28,479. December 10th.

1913.

Method of Rotating a Magnetic Armature Step by Step. Siemens Bros. and Co. (Siemens & Halske Akt.-Ges.) 1,277. January 16th.

Electric Resonance-operated Apparatus. H. W. Hancock, A. H. Dykes and W. Duddell. 1,895. January 17th.

Supports for Electric Hand-irons during Heating. H. Sameli. 1,562. January 20th.

Electrolytic Iron.—In a recent issue of the *E.T.Z.*, M. Breslauer reports the result of his investigations concerning the advantages of electrolytic iron in the manufacture of induction and D.C. motors and transformers. The Leipzig firm of Langbein and Pfannhauser now market blocks and thin sheets of iron prepared electrolytically by Fisher's process, and this material has excellent magnetic properties—particularly in respect of permeability. Hysteresis losses are extremely low and may be taken as $0{\cdot}98 \times 10^{-8} \cdot B^2$ watts per kg. at 50 cycles per sec. Owing to its high electrical conductivity, eddy-current losses are high in electrolytic iron, but, on the other hand, the latter can be obtained in very thin and flat plates giving a smooth and not oxidised surface. The coefficient of solidity of a core made up of 0·25 mm. plates of electrolytic iron is 85 per cent. If plates of this thickness are used at 70° C. in a dynamo (50 cycles and 10,000 gauss), the total iron losses are 1·66 watts per kg. as compared with 2·8 watts per kg., using ordinary 0·5 mm. plates under the same conditions. Using 0·25-mm. electrolytic plates in transformers, the iron losses may be reduced to 1·23 watts per kg. as compared with 1·45 watts using 0·4-mm. alloy plates.

The following table, showing the ampere-turns per cm. required to produce various inductions in the irons stated, demonstrates the great advantage of electrolytic iron in respect of permeability :—

Gauss.	Electrolytic iron.	Ordinary iron.	Special iron.
7,000	0·4	2-4	2
10,000	0·7	5-6	5·5
15,000	4·0	24-32	52·5
18,000	72	146-180	260

As regards price, electrolytic iron costs 5·4d. per lb. and special transformer iron 3·5d. per lb.

In the case of an induction motor (230 mm. overall diameter × 100 mm.) and a 30-KW., 50-cycle transformer (copper losses = 87 per cent. iron losses ; cooling, 7 w. per dm.^{2}), electrolytic iron offers the advantages indicated by the following data :—

	Induction motor.		Transformer.	
	Electrolytic iron.	Ordinary plates.	Electrolytic iron.	Special plates.
Induction (gauss) ...	—	—	13,000	9,000
Power (KW.)	3·5	2·5	—	—
Weight of iron (kg.) ...	20	21	154	243
Weight of copper (kg.)	8	7·2	51·5	82
Efficiency (per cent.) ...	83	78·5	—	—
Ratio of no-load to full-load current	0·45	0·48	—	—
Cost (shillings)... ...	—	—	408	518

In transformers with artificial cooling, full advantage can be taken of the high permeability of electrolytic iron, and the losses on overload of a transformer in which these plates are used decrease owing to the high temperature coefficient of the electrolytic iron.

Not much advantage can be gained in D.C. armatures by the use of electrolytic iron, since the teeth ordinarily work at 22,000 gauss, and this limit must not be exceeded in pure electrolytic iron, but considerable saving may be effected in the field system. The poles are in any case well saturated, but, using electrolytic iron, the yokes may be worked at 17,000 instead of 13,000 gauss, using the same number of ampere-turns. In the case of a 300-KW. 375-R.P.M. machine, the weight of the field system is reduced 22·5 per cent. by using electrolytic iron in place of cast-steel. The new material will certainly play an important part in the design of commutating poles, the poor conductance of which is at present responsible for the magnetic dispersion which occurs on overload.